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[OFFICIAL NOTICE.]

Twentieth Annual Meeting of the American Gas Light Association.

Extract from the Constitution.—"Sec. 12. Application for Active Membership or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on."

General Announcement.

The twentieth annual meeting of the American Gas Light Association will be held in Boston on October 19th, 20th and 21st. The headquarters will be at the Parker House, in School street. The members will be called to order on the morning of Wednesday, Oct. 19th, at 10 o'clock, by the President, Wm. Henry White, Esq.

The following papers are promised:

1. "The Relation of Theory to Practice," by Alex. C. Humphreys, Philadelphia, Pa.
2. "Water Gas Condensation," by John M. Rusby, Jersey City, N.J.
3. "A Gas Association and its Members," by Walter R. Addicks, Boston, Mass.
4. "Saving and Proper Concentration of Ammoniacal Liquor," by George Osius, Detroit, Mich.
5. "Anthracites of the United States," by C. R. Collins.
6. "Some Experiences as to the Best Burner for a Mixture of Coal and Water Gases in about Equal Proportions," by Alfred E. Forstall.

It will be seen that we have but few papers this year, which is owing to the late withdrawal of some of those promised, although much effort has been made to secure others. This leaves plenty of opportunity for developing the possibilities of the question box, and it is hoped that the members will take advantage of it to bring up before the Association the discussion of many valuable points which may not be touched upon by or included in the subjects of the papers.

Members are specially urged to send to the Secretary *in advance* all questions which they would like to hear discussed in the meeting.

The meetings of the Association will be held in Pierce Hall, corner Huntington avenue and Dartmouth street.

The attention of the members is called to the bulletin board, which will be placed in lobby of Parker House. Notices in regard to the meeting, and especially changes in and additions to the printed programme, will be posted thereon, and it will, therefore, be well for the members to consult it from time to time.

As much valuable time is usually lost in calling the roll, and as but an inaccurate list is thus obtained of the members present, it is proposed this year to follow the same method as at the last two meetings, by having the members hand in their names to an attendant as they enter the meeting room for the *first time*. A special blank card has been adopted for this purpose, and these cards with pencils will be handed to members outside the hall door. Members will please write thereon their names and post office addresses.

The Committee of Arrangements is providing for the entertainment of the members during the time that they are not occupied with the business, which is the prime object of the meeting. The pleasure of the ladies will, as usual, be carefully provided for. No full programme has yet been furnished the Secretary, but he is able to announce a banquet to be tendered the members by the local Gas Companies, on the evening of Thursday, the 20th, at the Hotel Vendome.

Members wishing to provide for comfortable hotel accommodations should remember that Boston is full of visitors at the time selected for this meeting, and, therefore, they should engage rooms well in advance. The Parker House and Young's, under the same management, are but a few steps apart, and rooms on the European plan may be secured at from $1.50 to $2.50 (with bath), to $6, and like terms at the Victoria, which is about two blocks from the meeting hall, and several other first-class houses. The Parker House will not be able to accommodate all the members, and, therefore, for the information of those not familiar with Boston, the following hotels, all fairly convenient to the headquarters, are mentioned: The Adams House (European plan, $1 to $5), Hotel Reynolds (European plan, $1 to $6); Vendome (American plan, $4); Quincy House (American plan, $3 to $5); and the Copley Square and Thorndyke, both on American and European plans. There are many others within convenient distance. The Committee announces that no special rates can be obtained at any of these houses; the regular rates vary, and some of the members may prefer to correspond with a number of these houses before selecting. Each of the houses named will afford thoroughly comfortable accommodations.

The Secretary also announces that the Council will recommend to the Association that Section 41 of the Constitution be amended by adding the following words: "and all parliamentary procedure not specifically covered by this Constitution shall be governed in accordance with 'Roberts' Rules of Order.'"

The Secretary respectfully calls to the attention of those whom it may

concern part of Section 52, which reads: "Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll of membership by a vote of the Council."

The Secretary is sorry to find that unless the payments received between now and the time of meeting render it unnecessary, he will be obliged to report to the Council a number of names that he feels sure are only on the list through inadvertence on the part of the members. Dues are payable in advance. If not already attended to, will the members please remit for their dues *before laying this circular aside?*

Transportation.

The following passenger Associations have granted the usual concession in railroad rates, namely:

The Trunk Line Association, composed of the following railroads: Addison & Pennsylvania; Allegheny Valley; Baltimore & Ohio (Parkersburg, Bellaire and Wheeling, and east thereof); Baltimore & Potomac; *Bennington & Rutland; Buffalo, Rochester & Pittsburgh; Camden & Atlantic; Central of New Jersey; *Central Vermont; Chesapeake & Ohio (east of Charleston, W. Va.); Cumberland Valley; Delaware & Hudson Canal Co.; Delaware, Lackawanna & Western; Elmira, Cortland & Northern; Fall Brook Coal Co.; *Fitchburg; Fonda, Johnstown & Gloversville; *Grand Trunk; Lehigh Valley; New York Central & Hudson River; New York, Lake Erie & Western (east of Salamanca, Dunkirk and Buffalo); New York, Ontario & Western; New York, Philadelphia & Norfolk; Northern Central; Pennsylvania; Philadelphia & Erie; Philadelphia & Reading; Philadelphia, Wilmington & Baltimore; Rome, Watertown & Ogdensburg; Western New York & Pennsylvania; West Jersey; West Shore; Wilmington & Northern.

The New York and Boston lines, between the two places named, viz.: Boston & Albany Railroad; Fitchburg Railroad; New York & New England Railroad; New York, New Haven & Hartford Railroad; New York, Providence & Boston Railroad; Old Colony Railroad; Fall River Line; Norwich Line; Providence Line; Stonington Line.

The Southern Passenger Association, composed of the following companies: Alabama Great Southern; Atlantic Coast; Atlanta & West Point; Brunswick & Western; Charleston & Savannah; Central Railroad of Georgia; Cincinnati, New Orleans & Texas Pacific; East Tennessee, Virginia & Georgia; Georgia Railroad; Georgia Pacific; Illinois Central (lines south of the Ohio river); Jacksonville, Tampa & Key West; Louisville & Nashville (lines south of the Ohio river); Louisville, New Orleans & Texas; Mississippi & Tennessee; Mobile & Ohio (lines south of the Ohio river); Memphis & Charleston; Nashville, Chattanooga & St. Louis; New Orleans & Northeastern; Norfolk & Western; Pennsylvania Railroad (lines south of Washington); Port Royal & Augusta; Raleigh & Gaston; Richmond & Allegheny; Richmond & Danville; Richmond, Fredericks & Potomac; Rome Railroad; Savannah, Florida & Western; Seaboard & Roanoke; Shenandoah Valley (lines south of Potomac river); South Carolina Railway; Vicksburgh & Meridian; Western & Atlantic; Western Railway of Alabama.

The Central Traffic Association, covering the following ground: Bounded on the east by Pittsburgh, Salamanca, Buffalo, and Toronto; on the north by the line of and including points on the Grand Trunk Railway, from Toronto to Port Huron; thence via Lakes Huron and Michigan to the north line of Cook County, Illinois; on the west by the west line of Cook County and the Illinois and Mississippi rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio river, but including points on either side of that river.

The Western Passenger Association, covering territory west of Chicago and St. Louis, *decline* to grant any concession on account of the probable limited attendance from this territory. Members interested are referred to the fifth rule below, under which they can secure special rates from Chicago and St. Louis. (The Chicago & Alton Railroad, operating in this territory, individually grants concession as herein described from all points in Illonois to Chicago or Bloomington.)

The usual concession in railroad rates has been granted, namely, one-third off on the round trip. That is, members will pay full fare going, obtain a certificate from the ticket agent from whom they purchase their tickets, and, upon presentation of this certificate at Boston, duly endorsed by the Secretary, they can obtain the return ticket at one-third the full fare rate. To illustrate: Suppose the regular fare from some point to Boston to be $30. At the time of purchasing his ticket to New York the member pays $30 and obtains the necessary certificate from the agent; he has that indorsed by the Secretary, at Boston; then, on presentation of the same to the ticket agent at Boston, he can procure a return ticket by payment of only $10.

The following extracts from the regulations of the railroads are cited for the information of the members. The special rates are granted subject to these regulations:

1st. The American Gas Light Association is obliged to guarantee to redeem at full fare rates any return tickets procured by persons in attendance at meeting which may afterwards be found in the hands of "scalpers."

2nd. The reduction is conditional on there being an attendance at the meeting of not less than 100 persons holding certificates.

3d. Each person, to obtain the excursion rate, must purchase a first-class ticket (either limited or unlimited) to the place of meeting, for which he will pay regular fare, and upon request, the ticket agent will issue a printed certificate of purchase of the standard form. Agents at all important stations are supplied with certificates.

* Only for business originating at, or destined to, stations on the direct lines of these roads between Troy, N. Y., and Montreal, Canada.

4th. If through tickets cannot be procured at the starting point, purchase short-trip ticket to the most convenient point where such through tickets can be obtained, and there purchase through to place of meeting, requesting a certificate from the ticket agent at the point where second purchase is made.

5th. Tickets for the return journey will be sold by the ticket agents at the place of meeting at one-third the highest limited fare, only to those holding certificates signed by the ticket agent at point where through ticket to place of meeting was purchased, and countersigned by signature written in ink by the Secretary of the Association, certifying that the holder has been in regular attendance at the meeting.

6th. No reduction of fare will be made on the return passage if the going ticket is purchased more than three days before the opening date of the meeting; except that when meetngs are held at distant points to which the authorized limit is greater than three days, tickets may be purchased before the meeting in accordance with the limits shown in regular tariffs.

7th. Certificates are not transferable, and return tickets secured upon certificates are not transferable.

8th. The certificate of agent at starting point, duly endorsed by the Secretary of Association, must be presented to ticket agent at the place of meeting, within three days (Sunday excepted) after adjournment of meeting. The return ticket will be for the line or lines covered by the going ticket.

9th. No refund of fare will be made on account of any person failing to obtain a certificate.

Important.—Be sure to obtain your railroad certificate when buying your ticket for Boston. Apply for ticket and certificate at least 30 minutes before train time. A separate certificate is necessary for each individual obtaining the reduced rate. Be sure to have the Secretary indorse your certificate at Boston. Apply for return ticket at least 30 minutes before train time, and have your certificate with you. Members will please hand their certificates to the Secretary, or his clerk, upon arrival at the place of meeting. If there are 100 members present, holding certificates, each certificate will then be properly indorsed and handed back to owner, before adjournment. Keep this circular in your pocket, and apply to it if you are in doubt.

Section 51. "No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings."

This provision of the Constitution will be enforced at the coming meeting.

ALPHEUS B. SLATER, JR., Secretary.

PROVIDENCE, R. I., Sept. 12, 1892.

BRIEFLY TOLD.

THE COMING MEETING.—We reprint to day, and shall continue to so do in the numbers that will be issued between now and the time set for the Boston meeting, the official notice prepared by Secretary Slater regarding the gathering. The members will undoubtedly find something new in the circular each time, for the officers and the Committee of Arrangements are perfecting the details, as time passes. The transportation preparations have been completed, and fully 75 per cent. of those that will be in attendance can save themselves something by taking advantage of the instructions in the circular. As was said in the JOURNAL for last week, the paper list will be augmented by at least one additional contribution, and it is more than likely that still another will come to hand. The Secretary's request that questions for the question-box should be forwarded to him well in advance of the meeting should be heeded and acted upon as soon as possible. The outing programme is receiving much attention from the Committee, who promise much, and who are noted, every one of them, for redeeming their promises.

COMMISSIONER BARKER AT HOME AGAIN.—Mr. F. E. Barker, of the Massachusetts Board of Gas and Electric Light Commissioners, is back at his post from his recent European trip, which he enjoyed most thoroughly. It looks rather superfluous to add that a wideawake man like Barker would have seen much, and have that which he saw pretty well fixed in his mind, during his European journeyings; but we are prompted to the thought that he saw and remembered through having read in some of the Eastern dailies—notably the Worcester (Mass.) *Telegram*—the report of an interview had between him and a reporter of that paper. Evidently, the Commissioner was misreported, for we are confident that some of the sentiments attributed to him in that interview never were formed in his judgment or even uttered by him—of course, the burden of the interview largely related to the industry on both sides of the Atlantic, and to comparisons, as to the practice in the industry, here and there. We hope to have appear in the JOURNAL a correct report of the Commissioner's "impressions" on these matters.

ATTENTION is called to the advertisement in which the Exeter (N. H.) Gas Light Company offers for sale 100 barrels of coal tar.

The Behavior of Oxygen when Air is Used in the Purification of Coal Gas.

[Read by Mr. Thomas Stenhouse, F.I.C., at the August meeting of the Manchester District Association of Gas Engineers.]

Several gas works use air, and some few use oxygen (more or less pure), to get rid of the sulphureted hydrogen occurring in unpurified coal gas. It is well known that, if sulphureted hydrogen be broken up by means of oxygen, either in a lime purifying box or in a Claus kiln, one volume of the former gas requires half a volume of the latter; thus—

$$2\,SH_2 + O_2 = 2\,OH_2 + S_2.$$

Crude coal gas, containing 1,000 grains of sulphureted hydrogen per 100 cubic feet, has in it about 2 per cent. by volume of sulphureted hydrogen. Such a crude gas, therefore, requires 1 per cent. of oxygen, or 5 per cent. of air, to oxidize the hydrogen of this sulphur compound and set free the sulphur. This, of course, is on the supposition that, if the requisite amount of oxygen is present, the sulphureted hydrogen is sure to be decomposed. Though this decomposition is almost perfect when sulphureted hydrogen and half as much oxygen, or its equivalent of air, pass together through the layer of heated oxide of iron in a Claus kiln, nothing like the same reliance can be placed on the action of the two gases while passing through an ordinary lime purifying box at the usual comparatively low temperature. Merely mixing sulphureted hydrogen, or coal gas containing it, with air or oxygen, produces no change. This badly smelling gas is not decomposed when it escapes into the air of any room—say, a chemical laboratory—although it then becomes mixed with hundreds of times its own volume of oxygen.

The reaction between sulphureted hydrogen and oxygen in a lime box is not a direct one. This is shown by the lime changing to a bluish green color when the crude gas containing oxygen is passed through it for a short time. The change may be easily observed by placing the lime in a glass vessel. The sulphureted hydrogen first combines with slaked lime to form various sulphides and basic hydrosulphides of calcium; and it is the hydrogen of some of this latter class of compounds which becomes oxidized when small quantities of oxygen are added to the crude gas. Other oxidation besides that of hydrogen may take place in a lime box. During such changes, water is, of course, formed; and one word about the water produced will not be out of place here. The hydrogen in every 17 grains of sulphureted hydrogen, decomposed in the way indicated, yields 9 grains of water, which requires disposing of in some manner. With a crude gas rich in sulphureted hydrogen, this water may amount to a considerable quantity. It smells strongly, and holds in solution a large amount of polysulphides of calcium dissolved out of the partly fouled lime. As it contains little or no ammonia, and deposits solid matters on being heated, it is not advisable to run the water into the ordinary gas liquor, because such a mixture will probably cause obstructions in a sulphate of ammonia still working on the continuous system.

Many experiments have been made at these works to ascertain how oxygen and air behave in their passage with the crude gas through not only the purifying boxes, but the scrubbers and washer as well. From a chemical point of view, it may seem altogether wrong to admit oxygen or air to coal gas before the latter has passed the scrubbers, as one would think that the gas liquor and tarry matters—containing, as they do, so many compounds capable of oxidation—would assimilate the oxygen long before the purifiers were reached. Such is not the case, however. The union of oxygen with the substances referred to depends largely, if not entirely, on the temperature. No added oxygen, or only an infinitesimal quantity, is absorbed in the washer and scrubbers. In some works it will be found much easier to add air or oxygen before the gas reaches the scrubbers than afterwards. When this is the case, there need be no fear of oxygen being wasted.

We will now assume that the purifiers are reached; that they consist of three lime boxes followed by two other boxes charged with oxide of iron; that the gas entering the series contains 1,000 grains of sulphureted hydrogen per 100 cubic feet; and that air to the extent of 5 per cent., or oxygen to the extent of 1 per cent., has been added to the crude gas. According to a recent theory, this quantity of oxygen should decompose all the sulphureted hydrogen in the lime boxes, and set the sulphur free. This is not the case, as somewhat stable sulphides of lime begin to form at once; and no ordinary amount of oxygen in the gas—not even 2 or 3 per cent.—will decompose them. Proof of this can be easily demonstrated. Mix crude gas with any amount of pure oxygen (say, up to 5 per cent.), and pass the mixture slowly for some time through a layer of lime. If the crude gas be then shut off, and air or oxygen alone be sent through the partly fouled lime, rapid oxidation of the newly formed sulphur compounds commences at once, and the lime soon becomes unbearably hot to the touch. No such result as this would be possible if all the hydrogen of the sulphureted hydrogen had been oxidized in the first instance, and the sulphur liberated.

When a lime box has become considerably fouled, even when oxygen or air has been used, carbonic acid gas will liberate sulphureted hydrogen in the usual way. At the outlet of such a box (say, the first of the series), it is not unusual to find something like 1,200 grains of sulphureted hydrogen per 100 cubic feet, although only about 1,000 grains occur at the inlet of the box. Under such circumstances, carbonic acid gas and bisulphide of carbon are being absorbed by the lime—the carbonic acid often to the extent of 400 out of the 800 grains which may be present in every 100 cubic feet of the crude gas. In fact, it is a common occurrence to find from 25 to 50 per cent. of the total oxygen added to the crude gas, pass through the whole of the lime boxes without reacting with the sulphureted hydrogen, although from 300 to 400 grains of this gas per 100 cubic feet may be leaving the last of the three lime boxes. The escape of this oxygen through the purifiers, and its ultimately forming a constituent of the purified gas, could not be considered a loss if there were any real foundation for the current supposition that a small percentage of oxygen in purified coal gas increases its illuminating power. Numerous and careful tests have been made at Rochdale with 18 candle gas—first without any added oxygen, and afterwards with amounts varying between 0.1 and 0.5 per cent.—but no increased illuminating power has been obtained. In using air or oxygen for the destruction of sulphureted hydrogen in lime boxes, it will still be necessary for gas managers to remember that lime water alone is not a test for carbonic acid when this gas is accompanied by an excess of sulphureted hydrogen. Under such circumstances, the partly purified gas should pass through a small glass vessel containing oxide of iron before being allowed to bubble through the lime water. Omitting this precaution has misled many while making a qualitative test for carbonic acid.

To particularize a little more fully respecting the purification, it may be stated that in each of the lime boxes there are two layers of lime, each about 9 inches thick—giving a total thickness of 4½ feet in the three boxes—through which the gas passes at the rate of about 44 cubic feet per hour per square foot of area. The oxygen in the crude gas is generally about two-thirds of the theoretical quantity required for the simple oxidation of the hydrogen of the sulphureted hydrogen. The bulk of the oxygen taken up is absorbed in the third and newest lime box, and very little in the first two, which are always considerably fouled, and retain very little of the sulphureted hydrogen compared with the amount fixed in the third lime box. Generally speaking, out of the 0.7 to 0.8 per cent. of oxygen in the crude gas, only about 0.2 per cent. is used up in the first two boxes; from 0.4 to 0.5 per cent. in the third box; while 0.1 to 0.2 per cent. goes forward with the gas into the two oxide of iron boxes. It rarely or never happens that all the oxygen, whatever the percentage, is used up in the lime boxes; and only for about two days—sometimes not even one—after putting on a new lime box is all the sulphureted hydrogen absorbed by the lime. When an excess of oxygen (say, about 1.2 per cent.) is sent into the crude gas for a few hours, the larger quantities of oxygen previously mentioned pass unabsorbed through the whole of the purifiers.

As regards the foul lime in a box recently thrown off, the upper tier is always damper and more darkly colored than the other. The lower layer of lime is often very dry, and contains a great many small, hard pieces of sulphided lime, each with a nucleus of unchanged calcium hydrate. The whole of such a floor contains about 15 per cent. of unaltered calcium oxide; and the chemically-free sulphur—probably derived from the decomposition of polysulphides—amounts to about 5 per cent. only. When the lime from a box of this description is broken up, watered, and again used in the first box of the series, it becomes very active in the absorption of both sulphureted hydrogen and carbonic acid for about a couple of days, after which the lime is quite useless for purifying purposes.

To obtain the best results in purification by the aid of air or oxygen, there can be no doubt that a large purifying area is a great advantage. The use of air or oxygen lessens the offensiveness of the fouled or spent lime, besides rendering a box active for a longer period. It also diminishes the sulphur compounds in the purified gas. The question as to whether one does not pay too dearly for the advantages by the depreciation of the quality of the gas, owing to the presence in it of the nitrogen of the air used, is one which those who are better versed in gas matters than I am must decide. A similar question may also be asked as to the cost of manufacturing oxygen from baryta at gas works, and the value of any advantages obtained from its use in purification work.

The foregoing remarks relate to observations and experiments made at the Rochdale gas works; but it is not unlikely that at other works, with less sulphureted hydrogen in the crude gas, different modes of purifying, or other qualities of lime, etc., different results in some respects will be obtained.

Having finished the set paper, Mr. Stenhouse treated the Association to a series of experiments. He passed a slow current of oxygen through wide glass tubes containing lime, which had become partly fouled by the passage of gas containing 2 per cent. of free oxygen. In a few minutes the lime in the tubes became very hot, owing to the oxidation of some of the sulphides of lime. The strong liquor (18° Twaddel) from the bottom of the lime boxes was shown, and also a quantity of sulphur which the liquor yields on adding hydrochloric acid; the acid decomposing the polysulphides. The action of crude gas, containing both sulphureted hydrogen and carbonic acid, on lime water was also shown.

Discussion.

Mr. Isaac Carr (Widnes) remarked that the theories propounded in the paper met with general acceptance; and the reaction which had been described by Mr. Stenhouse no doubt took place. But the point in which he (Mr. Carr) was most interested was the cost of the oxygen per 1,000 cubic feet. His own idea was that it was about 5s. If that was so, it meant £2 10s. per million cublic feet for oxygen alone; and in addition to this, there was the cost of the purifying material. In ordinary gas works—his own, for instance—the total cost of purification did not exceed £1 per million cubic feet; and he believed it was not more than £1 10s. in the majority of cases. Before thinking of adopting this process, he should like to know whether he was right in these figures. If they were correct, the cost seemed almost prohibitive. Another material was being used for purification which had points of similarity to the process described. He referred to oxide of manganese, or "Weldon mud." A purifier charged with Weldon mud was put on, and a stream of air passed in along with the gas; and it was said that the material would absorb some 50 per cent. of sulphur without being removed from the purifier. So great was the affinity of manganese for air, that there was very little danger of air passing the purifier and reducing the illuminating power of the gas. This seemed very nice; but he feared that, as in the case of the oxygen process, the cost was prohibitory.

Mr. Thos. Newbigging (Manchester) said the members had had a most interesting and suggestive paper, and he only regretted that they could not have had it in print a few days sooner, in order to have carefully perused it and come to the meeting prepared to speak with some weight upon the subject. Several points were put by Mr. Stenhouse in a clearer light than they had hitherto been placed by anyone dealing with the question of air or oxygen purification. In listening to the paper, he had been struck by the fact that advances were made step by step, and one discovery led to another. In the earlier days of the use of air or oxygen in gas purification, it was thought that the oxygen acted only on the foul oxide contained in the purifier, and so prolonged the purifying process. Whether or not it was first used in London, he did not know, but he believed it was first employed in Lancashire with knowledge of what the effect was. Now they found that more complex chemical reactions occurred, and that when air or oxygen was drawn or forced through the purifiers, the oxygen acted upon the sulphureted hydrogen—liberating the hydrogen in the form of water, to be deposited or absorbed later on. This was a great step in advance. The paper did not deal at all with the original process. In fact, it dealt scarcely at all with the old idea of the use of air in purification, but almost entirely with the effects of air and oxygen, apart from the revivification of oxide of iron. He should have been glad if Mr. Stenhouse had given the cost of the oxygen, as suggested by Mr. Carr; but he (Mr. Newbigging) supposed they would have this later on in the discussion. It was a great advantage to have a good chemist at a gas works; and, in his opinion, a chemist should be employed at all sufficiently large works—at all those where they could afford to pay him for his labor—not merely for testing whether the oxide was spent, and whether there was only a certain quantity of sulphur in the gas, but for the purpose of research. Such information as the members had received that day from Mr. Stenhouse was to be obtained by employing a chemist at a gas works; and he was sure that greater progress would be made if his suggestion were adopted. He agreed with Mr. Stenhouse that, to obtain the best resuls, a large purifying area was necessary; for he did not share the opinion that, if the oxygen process was adopted, they could reduce the size of the purifiers. All chemical processes must be slow, and whether or not the oxygen process was good, they must have a large purifying area.

Dr. L. T. Thorne (London) said he had listened to the paper with much interest, and there were two or three points in it to which he should like to refer. When Mr. Stenhouse put down the reaction—

$$2SH_2 + O_2 = 2OH_2 + S_2,$$

that expressed roughly what might be called the net result; but, as the author had explained in his paper, what actually took place was not a simple reaction like that. They did not understand what reaction was taking place in the purifiers with the use of oxygen—whether pure or in the form of air. There was no doubt that the full action of the oxygen took place only after a certain amount of sulphides, polysulphides, or hydrosulphides of lime had been formed; and thus enabled it to react on the sulphur compounds and the carbon disulphide in the gas. It was really the decomposition of the first products of purification, and not the direct decomposition of the sulphureted hydrogen, or, at all events, not its direct oxidation, except through the intermediation of the third substance—the lime or iron oxide. After studying the subject carefully for some years, he was inclined to believe that the reactions were a good deal more complicated than was at first anticipated; and that the products formed and again decomposed in the purifying boxes were many, and probably very complex. He was surprised to find Mr. Stenhouse saying that, where sufficient oxygen was continuously used, carbonic acid gas would decompose the lime in the used up boxes and liberate sulphureted hydrogen. In experiments he had made himself, he had found the reverse to be the case. In these experiments, although crude gas containing carbonic acid was passed through the foul boxes, no increase of sulphureted hydrogen was given off at the outlet of the purifiers. No doubt the process which was going on in the lime boxes was of a complicated character; and the temperature, the nature of the lime, the amount of moisture present, and the state of division of the lime, played a greater part than one would at first suppose. This was the only explanation he could find for the fact that they had different results in Rochdale from those obtained in Shrewsbury and in Ramsgate, and, he believed, in Dukinfield, though in the latter place oxide of iron in place of lime was employed. As to the need for ample purifying space, he agreed with Mr. Stenhouse and Mr. Newbigging up to a certain point; but he did not think an excessive space was advisable where oxygen was used for purification. In experiments which he had made, he found that, where the rate of gas was increased, the purifying was actually more efficient, and was better than when the gas travelled at a *very* slow rate. Purification had also, in some cases, been improved where a slightly smaller quantity than the theoretical amount of oxygen was employed. It seemed to him that, if they had too large an area, the more highly sulphided compounds were not formed, or were so rapidly decomposed again that they were not able to play their full part in purification. These compounds, he believed, were those most easily acted upon by the oxygen, and were those from which the sulphur was deposited. This was a very curious point, and required more working out; but he believed it would be found that, although a fair purifying area was advisable, a large excess of it was detrimental rather than otherwise to the success of the process. This was specially noticeable at Shrewsbury. When the process was first adopted there, they had very large purifiers and a summer make of gas; and the purification was less satisfactory than when the production increased in the autumn and winter months. With regard to what Mr. Carr had said as to the use of Weldon mud, he (Dr. Thorne) had had very little opportunity of following the experiments made with this material. He did not know if he had quite understood what Mr. Carr had said as to the affinity for air of the manganese in the Weldon mud, and that affinity preventing deterioration of the quality of the gas. It was something new to him if Weldon mud would absorb nitrogen, which was the deteriorative portion of the air. If it would do this, Weldon mud had a large future before it; but at present he was rather sceptical on the matter. Mr. Stenhouse had stated that in the purified gas at Rochdale there had been no increase of illuminating power by the addition of a very small percentage of oxygen. This was a result at which he (Dr. Thorne) had been very much astonished, and at present he did not understand it. Certainly, in this case, with purified gas, the addition of a small quantity of oxygen did not increase the illuminating power; but, with regard to the oxygen process, the claim had not been that oxygen should be added to the purified gas, but to the crude gas before it passed through the purifiers. As he had previously said, he believed the action which went on in the purifiers was very much more complicated than was generally imagined; and it might be that the increase of illuminating power obtained in some cases was due to this action. It was quite possible to imagine that, in the presence of sulphur compounds, sulphureted hydrogen, oxygen, and active agents like iron or lime, there might be a reaction taking place which would produce small quantities of carbureted hydrogen. It was very difficult to say, but he was convinced, from

the experience at Shrewsbury, Ramsgate and other places, that there was an increase in illuminating power if the oxygen was used before the purifiers. Whether or not this increase was owing to any action on the purified gas, which did not take place in Rochdale, was a moot question. It might, as he had suggested, be due to a process going on in the purifiers. The careful experiments of Mr. Stenhouse on purified gas certainly did not show any increase of illuminating power; but whether this was attributable to the composition of the coal used at Rochdale, or to any other of the causes he had suggested, he could not tell.

Mr. Harrison Veevers (Dukinfield) thought it might be useful if he gave something of his experience as a practical gas manager. He had had the oxygen process at work for two months; and though, of course, he could not yet give any figures as to the cost of the oxygen, or the economy resulting from the change, he might say generally that he was perfectly satisfied with the results. Upwards of seven weeks ago, he temporarily connected two purifiers and filled them with oxide, part of which had been used before; and since then he had not had to change. He had passed 4½ million cubic feet of gas through the purifiers, and still it was clear of sulphureted hydrogen. The quantity of oxygen he employed was 1 per cent.; and it was introduced before the exhauster and the scrubbers. Whether or not the oxygen improved the illuminating power he could not say; but the gas had in fact been of higher value since the adoption of the oxygen process. This might, however, be due to the fact that they had not had to raise the purifier lids so frequently as before. Removing the lids daily, or sometimes twice a day, meant not only great loss of gas, but the inclusion of a quantity of air which was perhaps great in proportion to the quantity of gas in stock, and thus deteriorated the quality. He hoped, at the next meeting of the Institution, to give the members a great deal of information on the working of the process at Dukinfield.

Mr. Carr, replying to Dr. Thorne, said he was fully aware that manganese had no affinity for nitrogen, and also that nitrogen reduced the illuminating power of gas. His point was this—that in the use of air with ordinary oxide of iron, as the oxide had less affinity for air or oxyen than manganese possessed, there was an increased liability for air to escape from the purifiers, and reduce the illuminating power of the gas, than if manganese were employed. This was the advantage of using manganese instead of oxide.

Mr. T. Banbury Ball said he did not think Mr. Stenhouse intended in his paper to say anything about the oxygen process as a process. The idea was simply to give the members some of the results noticed at the Rochdale gas works with the use of both oxygen and air; and the paper must be received in this light, and not with reference to the oxygen or any other process. He would emphasize what Mr. Newbigging had said about the advantage of having a good chemist at a gas works. He (Mr. Ball) was under many obligations to his colleague, Mr. Stenhouse, and he was most happy to acknowledge them. In conducting these and other experiments they frequently had to work together, and the assistance which Mr. Stenhouse rendered was very helpful. Dr. Thorne had mentioned the increase in the quantity of sulphureted hydrogen coming out of the foul boxes, as compared with the quantity at the inlet. There could be no doubt whatever about this. The fact was constantly coming under their notice; and it regulated, to a certain extent, the change in the boxes. In connection with these experiments he was very much struck by the large percentage of free lime—quicklime—which was always present among the foul lime. Mr. Stenhouse had mentioned it in his paper as 15 per cent.; and he (Mr. Ball) was not sure that it was not in some cases as high as 20 per cent., notwithstanding the fact that they had these boxes working long after the lime was thoroughly foul, and even delivering more sulphureted hydrogen at the outlet than was present at the inlet. This also happened, as had been mentioned by Mr. Stenhouse: After the lime had been taken out, watered, and put back again, the boxes would absorb sulphureted hydrogen and carbonic acid for a short time, and the temperature of the gas passing through the boxes would go up from about 50° F. at the inlet to 90° F. at the outlet. This might account, to some extent, for the presence of sulphureted hydrogen at the outlet of the second box. They had the lime in one of these boxes broken up and put back again, and while it cleared the gas at the outlet of the first box, at the outlet of the second they had 3 to 4 per cent. of sulphureted hydrogen. He hoped the experiments would be continued; and perhaps, as the result, they might arrive at something which they did not at present anticipate. The paper before them was certainly novel in some respects, and there were some problems referred to in it which had not received the consideration they deserved—partly on account of the difficulty arising in connection with the chemical portion of them, and partly from the time they occupied in investigation. However, if the result of the experiments had been of interest to the members of the Institution, Mr. Stenhouse would, he was sure, be extremely pleased.

Mr. W. W. Hutchinson (Barnsley) said he should like to know if more than ordinary difficulty was experienced with regard to the pressure when employing the oxygen process. What was the variation in the pressure in the boxes between the use of the ordinary process and the oxygen or air process? Again, was the spent lime more difficult to get rid of than the ordinary gas lime? He should also like to know the proportion of lime used per million cubic feet, and whether more supervision was needed than was required under ordinary circumstances to keep the gas right.

Mr. Stenhouse, in reply, said it had given him pleasure to listen to the remarks of Mr. Newbigging and Mr. Ball. What Mr. Hutchinson had asked might be answered by Mr. Ball. When air was used in purifying there was not much increase in pressure. But with one per cent. of fairly good oxygen, and a pretty large make of gas passing through the lime boxes, the pressure occasionally suddenly increased. With poorer oxygen, and the gas passing more slowly, these sudden increases of pressure were not experienced. Mr. Newbigging asked about the lime. In a fouled box there was often 15 per cent. of lime unacted upon. This was because some of the lime became crusted over with the various sulphides, and the foul gas could not reach it. When the lime from such a box was broken up and exposed to the atmosphere, most of the fresh lime became free and active, and again capable of absorbing both sulphureted hydrogen and carbonic acid when put back into the box. Mr. Veevers had large oxide purifiers, and in the summer time the oxide was easily revivified *in situ* by oxygen. These boxes were not comparable to lime boxes. Possibly sulphur would be set free by oxygen in an oxide box; and this sulphur, while fresh, would absorb such compounds as bisulphide of carbon, and thereby reduce the total sulphur in the purified gas. Dr. Thorne referred to the lime boxes throwing off sulphureted hydrogen. In the speaker's experience this had taken place over and over again. He had known one-fifth more sulphureted hydrogen to leave a box than entered it; and their lime boxes were somewhat in that condition while he was speaking.

On motion of Mr. Duxbury a vote of thanks was passed to Mr. Stenhouse.

[Prepared by Prof. Arthur Lakes, for the *Colliery Engineer.*]

Colorado Coal Fields and the Difficulties Encountered in Valuing the Coal Lands, with Descriptions of the Various Districts and Kinds of Coal.

To some it might appear an easy thing to estimate the amount of coal and value of a coal property, particularly if the coal seam was nearly horizontal. They might think that all that was necessary was to estimate the number of acres on the property, measure the average width of the coal seam or seams, and say the property consists of so many acres underlaid by such and such a thickness of coal valued at so much per ton. But this assumes that a coal seam preserves an average even thickness and uniformity under a large tract of country and that it is undisturbed throughout. A condition rarely if ever the case. In the coal fields of Colorado the coal seams will often vary in thickness in a few yards. They will be split up by clay partings till the thickness and value of the seam are greatly reduced, or "rolls" may occur, bringing the coal down to a minimum by the roof or floor of the seam ascending or descending at intervals and pinching out the coal. Faults also may considerably disturb the coal seams, and with "rolls" involve a great deal of dead work to keep up the general grade of the entries. The coal seam may for a considerable distance maintain an average even thickness and then gradually thin out, to recommence or not in some more distant part of the property.

In the southern part of Colorado, where coal seams are horizontal or rarely dip more than 5 degrees, they are frequently invaded by dikes of eruptive rock, the heat of which has changed the coal adjacent to them to a hard useless coke. In one case that we observed, a dike 50 feet thick had so changed the coal for a distance of 30 feet on either side of it, the extent of alteration appearing to be commensurate with the size of the dike; in another case a horizontal intrusion of lava had turned the coal into three feet of impure and worthless graphite; and in yet another, the molten matter had completely burnt out the coal and replaced the seam with its own hard substance.

Besides this loss of coal, the dikes themselves are formidable obstacles; they are of intensely hard rock, and may be from 10 to 50 or more feet thick, and cannot wholly be avoided by the workings, for if we drive the main entries parallel with them, we must still meet and cross cut them in the cross entries. The course of some of these dikes is easily

seen on the surface, at others they are observed by surface matter and only met with in the mine. The main trouble with small faults of from 10 to 20 feet in a mine is the amount of "dead" work they cause in leveling up the tracks of the mine. A great fault in a mine may cause an abrupt ending of the work or oblige the opening of the mine in some other section of the property. Small faults can rarely be detected on the surface, but a careful study of the geology of the neighborhood may reveal the presence of the great ones. The rule that the "hanging wall" goes down and the "foot wall" usually rises may often enable the miner to recover his lost seam.

Again, as to the quality of coal, as a rule an analysis of a single coal seam gives pretty similar results throughout the entire course of the seam, but in some places little thin seams of shale or "bone" come in and cannot well be separated from the coal in working it; therein the final results will raise the amount of ash in the coal considerably, and deteriorate from its quality, especially for making coke.

Such being the common irregularities to be found in a coal seam in the mine itself, it is reasonable to suppose that some of these will be found also in the undeveloped, unexplored parts of the property, and that perfect uniformity of a coal seam under a large property can by no means be relied upon. If the property is a new one and has not been at all developed we are still more in the dark as to the future probabilities of the entire area. We can only form a rough estimate from the natural outcrop of the coal wherever they may appear. These are generally found on the side of hills, or on ravines and along the banks of watercourses. These outcrops will generally appear at the surface wider and thicker than the real thickness of the seams with depth.

In Southern and Eastern Colorado there is generally one main seam 6 to 8 feet thick, and several other smaller and subordinate ones which locally may attain a good workable thickness, but are unreliable and uncontinuous. In Colorado, where coal is so abundant and the seams are generally large, 4 feet is the minimum size usually worked. If a seam only shows up 4 feet on the outcrop, it is not safe to assume that it will continue a uniform workable size throughout its entire course.

In going over the surface of the property, if the coal seams are comparatively horizontal, care must be taken in the table lands usually characteristic of such a coal property, to observe whether the coal has been eroded off over certain areas. A prominent sandstone commonly underlies the principal seams, and the presence or absence of this is often a useful guide to decide whether the coal is or is not likely to be present. If the land of the property opened on the outcrop rises away from the outcrop, and there is a corresponding dip of a few degrees in the same direction, it is safe to assume that all the coal in this high land is well under cover. To test, however, this undeveloped, unexplored land, there is no other way than to put down a series of drill holes at different points. The records of this drilling rarely give very accurate results, though they are the best and only means we have for exploring undeveloped land. The diamond drill cores give fairly accurate records of the hard rocks and shales encountered with depth; but when it comes to the soft coal the action of the drill, and the water used, bring up but a soft friable core of coal, whose character is not very definite, whilst if there is any shale or "bone" in the coal, it is sure to record that and exaggerate its importance. Thus a seam recorded by the driller as slaty and dirty coal may on development prove a fairly pure one with only a little slate to deteriorate it. As a rule the drill records rather underrate than exaggerate the quality and thickness of coal encountered. About the best they do is to show that a certain amount of coal underlies or not a certain tract. A driller needs to be a very skilled one, and very watchful, to give a true record, and the owner of a property would do well to watch very carefully the work of the drillers, if he expects to get an accurate idea of what lies below ground. Before a large coal property is finally bought, a good deal of money should be expended in exploring it by drilling; drilling should also be kept up ahead of the development work. It is sometimes necessary to put down a number of holes within a comparatively short distance of one another before certain information can be obtained of the character of the coal; for a hole, for example, might by chance strike a seam where a local "roll" occurs and where the coal is nearly pinched out or cut up by partings, whilst a little further off the seam might retain its usual thickness.

The importance of putting down a number of exploring drill holes before great work is undertaken, was shown in a certain coal property in Colorado. The old mine caught fire, and it was decided to change the location of the plant and works. Accordingly the superintendent had a number of drill holes put down about 2,000 feet apart, encircling a certain area of coal land. All these holes showed good results and that the seam maintained throughout a good workable thickness. Accordingly the works and heavy plant were removed and located in the center of the land that had been explored on the outskirts. No holes were put down in the *immediate* vicinity of the spot chosen as the site of the new works, it being naturally assumed that the coal was all right there. A shaft was dug and timbered, and where it reached the coal the seam was so split up by partings and rolls that it was valueless, and it was not till something like 1,000 feet had been penetrated either way from the shaft that the good coal was again found. This error, of course, cost the company much labor, delay and expense. As a rule, the thickest and best coal is commonly found under that part of the property where there is the heaviest cover; thus if a prominent ridge or hill runs through the property, the coal is likely to be better there than in the lower lands. A very light cover will spoil the coal by the oxidizing action of surface waters; moreover, it is very unsafe to work coal under very light cover, for fear of its caving in.

Along the eastern foothills of the mountains of Colorado we have two large and distinct coal fields. The northern field is from the northern boundary of the State down to about the middle, near Colorado Springs. The coal is a first-class lignite, its high per cent. of water and volatiles and low per cent. of fixed carbon bring it just within the strict chemical definition of a lignite coal, but it is far superior to the common "brown lignite" of other regions. It is an excellent domestic fuel of good calorific power, yields very little smoke, and is remarkably free from ash—its percentage of the latter rarely exceeds 5 per cent. Its principal failing is its tendency to slack on exposure, hence it is not a good stocking coal. In the flat prairie region the seam or seams 6 to 8 feet lie comparatively horizontal, but along the edge of the mountains the same seams are tilted up at a steep angle. In these tilted seams, by pressure and heat, the coal is much better and harder, and slacks less than those in the flat seams; the hardness and quality increase with depth. This coal is a favorite for manufacturing purposes where intense heat is not required, also for domestic purposes; but it will not coke. From about the middle of the State, from Canon City down to the southern extremity at Trinidad, the coal is a true bituminous one. The lower half of this southern field, from about the Santa Clara river, is a good coking coal. The upper half to Canon City is a domestic coal. As these varieties of coal are all in the same geological horizon—viz., the Laramie Cretaceous—the change in quality is attributed to the eruptions of volcanic lavas, which increase toward the southern portion of the fields and diminish toward the northern.

The southern bituminous coal is, as a rule, less pure and free from ash than the northern lignitic field, its ash being from 8 to 15 or 20 per cent. The coke made is firm, bears a good burden, but carries a high per cent. of ash. Across the range is what may be called the western coal field of Colorado. The coal areas are very large, and the seams thick and in great numbers. The character of the coal is mostly bituminous; large areas make excellent coke, and a few small areas are semi-anthracite. The per cent. of fixed carbon is invariably high, and that of ash exceedingly low; hence the purity and fine quality of the coke as compared with the southeastern section.

The coal seams are commonly large sized and numerous, in one case—at Newcastle—attaining the unusual thickness of 45 feet. This seam, for one so large, is remarkably pure and free from clay partings. Most of these seams have been tilted to a steep angle of upwards of 45 degrees and are consequently less easy to develop than the horizontal measures. So numerous are the coal seams in this section, that it is not uncommon to see in a single cliff as many as six or eight workable seams exposed, aggregating a thickness of upwards of 100 feet of workable coal. In some of these fields the coal has been burnt for an unknown time, and in places is still burning. Hence in some of the mines operations have to be carried on some 100 feet below the natural water level, to avoid contact with the burnt or burning portions nearer the surface. In one mine on the great 45-foot seam, where they are approaching the burning area, the miners are singularly affected by soreness and granulation of the eyelids, which is attributed to the escape of carbonic acid gas.

The burnt areas are easily traceable on the surface by the redness of the sandstones, whose iron has been oxidized by the heat. In a few localities steam is seen coming out of the ground. The bulk of our mines in Colorado are not seriously affected by gas, though in most of them, especially in the soft coking coal mines, a certain amount of gas appears which requires careful watching, and which on one or two occasions has resulted in serious and fatal explosions.

The areas of anthracite, or rather semi-anthracite, for the so called "Colorado anthracite" will rarely attain the amount of fixed carbon characteristic of true anthracite, are quite small, and confined to areas where eruptive rocks have come in close contact with the coal seams and anthracised them. The same coal seam away from these hot influences is in its normal condition of bituminous coal.

Not infrequently, on the same face of a cliff, there may be as many as three or four workable seams, one of which is semi-anthracite, capped by an intrusive sheet of volcanic rock, another is a coking coal, and a third domestic.

Shale and sandstone form the ordinary roofs of the coal seams, and the case is rare where the roof is of sufficiently solid sandstone to dispense with timbering. The coal fields of Colorado are of enormous size both east and west of the range, and the coal will last for many centuries. The coal throughout is of exceptionally good quality, although it it is younger and occurs in a more recent geological horizon than that of Pennsylvania. The former belongs to the Laramie group of the cretaceous, the latter to the carboniferous period.

At one mine, in the southern field called Pictou, the coal assumes a singular, round, concretionary structure, and is locally called "nigger head" or pine knot coal. The cause of this peculiar form may have been that the coal at the time of its consolidation was in a soft, pulpy condition, and assumed the round, concretionary structure in the same way that clay and other soft substances are found to do. Generally the coal breaks in large, firm, lustrous cubes. A stratified structure in the layers of coal is often very distinct, whilst the well defined vertical planes of cleavage enable the coal to be easily worked and blocked off. The coal is a favorite throughout the State and has a large market as far east as Nebraska.

The New Welsbach Lamp.

[Paper read before the Austro-Hungarian Gas Association, 1892, by Herr Bossner; abridged for the *Gas World*.]

You all know how many efforts have been made to increase the lighting efficiency of gas. The hydrocarbons are decomposed, and the products in an incandescent state are themselves sources of light, until they are burned away by the oxygen of the air. The cold air runs in from all sides, and continuously cools the flame in an ordinary burner, and the incandescence of the carbonaceous particles is limited. Hence the need of raising the temperature of the flame. To do this by means of oxygen would be too troublesome and expensive; but it can be done by heating the air supply or the gas, or both, or by making an intimate mixture of gas and air before admission to the flame. In the first case we obtain an "intensive" gas flame; in the second we get very hot, non-luminous flames, which afford the means of bringing other objects to an incandescent state. This latter principle has been long applied, as in Drummond's lime light, and in the zirconia and magnesia light. But these methods had their defects, some requiring mechanical arrangements, and some being not bright enough. In the middle of the eighties Herr Auer von Welsbach announced his invention. After much experiment he had succeeded in preparing substances or mixtures which, in a finely divided state, on being brought to incandescence possessed a very high luminous emissivity. These substances, derived for the most part from minerals of high northern latitudes only, belonged to the group of the so-called rare earths, as lanthanium, erbium, didymium, thorium, etc. The form and the proportions in which each of the components is used have not been published. They very simply transform a part of the heat energy of a bunsen flame into the energy of light. It is, however, no secret that the lamps, as at first issued, were inconvenient and annoying, and made no way, though there was every disposition on the part of gas works to give them a favorable reception. In Vienna they disappeared more and more completely; public offices in which their use was enjoined returned to ordinary burners; and in 1890–91 there were exceedingly few in use in Vienna. The same state of things existed throughout the rest of Austria. But the position was changed at one stroke in October of last year, when Herr Auer von Welsbach announced a new discovery, the result of which has been an extremely rapid spread in the use of the new Welsbach lamps. The new discovery was that of a new impregnating material which causes so bright a light that a Welsbach burner now brightly illuminates a room. What, then, is the lighting power? It would be a mistake to give too precise numbers, because the glowing material may be larger or smaller, and give, accordingly, more or less light; and the yield in light also depends upon the proportion of the proper luminous material taken up. Any data that can be given belong therefore to the particular lamps examined, and may be too great or too small for another lamp. With these reserves I may mention that I have obtained, at the gas works, in Gaudenzdorf, the following results: Using 125 liters (4.41 cubic feet) of gas per hour and a pressure of 40 mm. (1.6 inch) a light of 72 candles was obtained with a Welsbach burner. The candles were the English standard. The old burners gave very striking results under a heavy pressure; but they did not last more than 50 hours. Pressure seems to affect the result by inducing a better admixture of the air and the gas, so that the combustion is more complete. The new Welsbach burners also burn better at high pressures, but use more gas. On the other hand, the lighting power increases more rapidly than the gas consumption, as the following table shows: At 25 mm. (1 inch), consumption 64 liters per hour (2.26 cubic feet), lighting power 26.7 candles, or 0.417 candle per liter (11.73 candles per cubic foot); at 34 mm. (1.36 inch), 77 liters, 59 candles, 0.766 candle per liter (21.55 candles per cubic foot); at 40 mm. (1.6 inch), 89 liters (3.143 cubic feet), 69.5 candles, or 0.781 candles per liter (21.98 candles per cubic foot.) In these experiments the ordinary Welsbach burners of commerce were used.

The following are the disadvantages of the new Welsbach lamps: The lighting power falls in course of time. After 410 hours use the burner first mentioned fell, under equal conditions, from 72 to 36 candles. This fall is at first more rapid, and then diminishes. It appears as if the heating decomposed the impregnating material, or as if it were volatilized or carried away in dust, so that less material was left to do the work. A precipitate is, in fact, formed on the interior of the glass chimney. The color of the light also, especially in the lamps which I first tested, was of a bluish-green, which many persons found unpleasant; but the latter samples gave a pure white light, and we are assured that this standard is to be maintained.

Thirdly, the hoods are too fragile. This is difficult to amend. They cannot be touched without injury after one burning; but they appear to be insensitive to ordinary shocks and vibrations. I have myself used one as the middle flame of a chandelier for the past four months; the servants have pushed the luster up and down in the usual way, and our servants are not renowned for extreme gentleness in dealing with their employer's furniture. That burner is still in use, uninjured. And more, I have myself experimented on it, lighting it from below, from above, with the spirit lamp, with a match, turning the gas off and on again, all without harming it. Lighting from above and turning the gas off and on again caused somewhat forcible explosions, but still it remained intact.

Fourthly, the chimney is apt to crack, and when it does so it smashes the hood. I think, however, that this is a fault of the chimney or of the way it is fixed, not of the Welsbach burner as such. If the hood be well centered and have no cracks in it to let the flame through, if the bunsen flame itself be well centered, and if the wire which holds the hood do not touch the chimney, the chimney rarely, if ever, cracks. Again, the iron ring which supports the hood breaks down after long use, and pieces of it fall upon and spoil the hood; but in the newest burners this support is made of a nickel alloy.

What, then, are the advantages and disadvantages of the new Welsbach burners? The public will be able to get more light with less gas. With gas at 5s. 10½d. per thousand, and Welsbach burners of 40 candles and 90 liters (3.2 cubic feet) consumption, the price will be 0.0045d. per candle per hour, as against 0.0200d. On the other hand, the burners are dear, and need renewals; the chimneys get broken; and the pipes ought to be adapted to the use of Welsbach burners, which means first cost. The gas works have to observe that the burners use less gas; but, on the other hand, they offer marked advantages. They develop much less heat than ordinary burners, thus approximating to electric glow-lamps; and they form less combustion products. These advantages are so marked that many users of the electric light in Vienna have given it up in favor of Welsbach lamps. These burners thus provide gas companies with a new weapon in their contest with the electric light. It cannot be expected that all, or even any very large number, of the consumers of gas can take to the Welsbach burner, which is rather, like the electric glow-lamp, a luxury light. But those who would be likely to use them are precisely those who would be likely to become users of the electric light, and who can, probably, be at the same time influenced by the greater cheapness of the new mode of illumination by gas, and thus retained as customers by the gas companies.

[Translated for the JOURNAL, by Mr. Herman Poole.]

Registering Manometer for Pressure of Gas, Steam, Water and Other Fluids.

[A paper read at the Tarbes meeting of the French Association of Gas Managers, by M. F. Marchal.]

Very often in winter, at the time of heaviest production of gas, w have found that at certain hours of the day the back pressure of the extractors attained great increase.

As these excesses of pressure should not occur, and since to remedy them it is necessary to know not only the amount, but also the duration, I have sought to register the pressure, which at times may reach as high as 30 or 35 inches of water.

To use an ordinary register, showing half or actual pressures, one having a scale of at least 20 or 40 inches would be required; these dimensions would be too large.

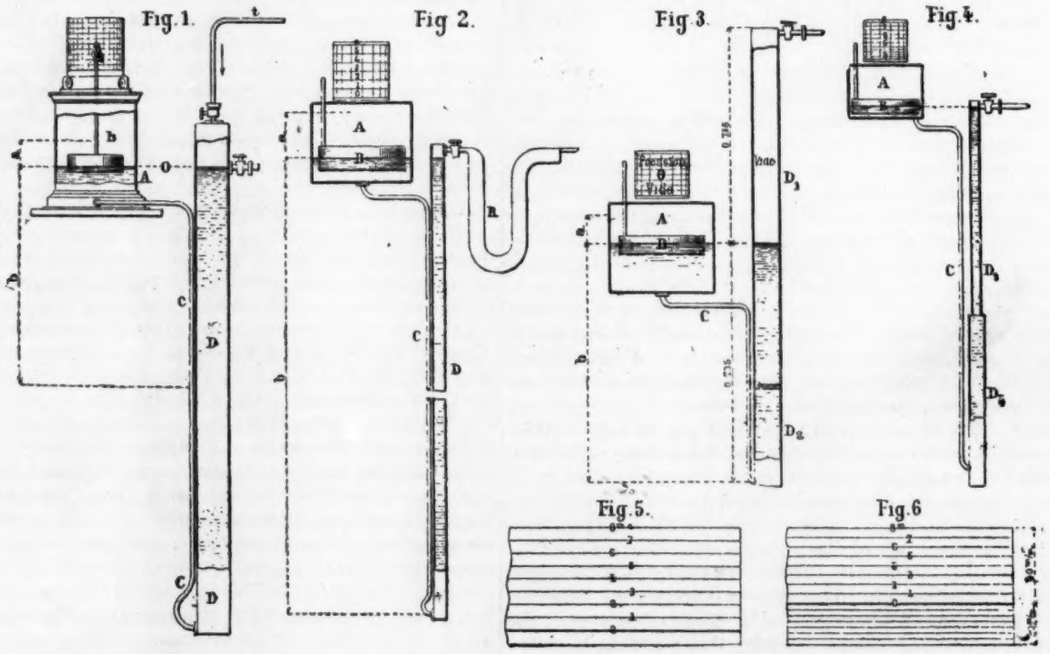
I give herewith a description, accompanied by drawinge (see illustrations), of the arrangement I have adopted and put in use at the gas works at Havre, since November, 1891, using a Brouardel register with a scale of about 4 inches.

The little gasometer has been replaced by an ordinary float, *B*, in such a way as to be able to follow the variations in level of the water in the cylinder, *A*. At one side is placed an iron tube, *D*, the bottom of which is connected with the lower part of the cylinder, *A*, by a lead tube some six-tenths of an inch in diameter.

The gas arrives at the upper part of the tube, *D*, and the level of the water in the cylinder and the tube is so regulated that the carrier reaches the zero mark when no pressure is on.

The height of the scale of the register being 4 inches, and the maximum pressure to be registered 40 inches, we must reduce the scale one-tenth.

According to the law of communicating vessels, if the pressure of the gas in *t* is increased, the level of water in the tube, *D*, will descend, and in consequence, the level in the cylinder, *A*, of the register will rise in such a way that the sum of the changes will equal the pressure to be measured. But this displacement will occur only in proportion to the sections of the tube and cylinder.



The maximum variations then will be:

Register 4 inches + tube 36 inches = 40 inches of total pressure.

We must then, in the present case, have the variations of one-tenth in the register and nine-tenths in the tube; consequently, the sections should be in the proportion of one to nine, and the diameters as one to three.

In another gas works, where the back pressure of the extractors never passes 20 inches, to utilize the 4 inches of the register scale the maximum variations of level should be:

Register 4 inches + tube 16 inches = 20 inches total pressure. The sections then would be in proportion of 1 to 4 and the diameter 1 to 2.

It is evidently indispensable that the section of the tube *D* be as calculated. To make it so, if the dimension is not to be had exact, take a tube with an approximate larger diameter and place in it a reglet with a sufficient section to bring that of the tube to the required one.

The indications furnished by this apparatus are very exact; they permit, moreover, the tracing day by day and hour by hour of the variations in the production of the works, as well as the increase in resistance of the apparatus behind the extractors, and from this vein provide for the prevention of obstructions which might have a tendency to form.

The applications of the principle above are very numerous. We might say they reach the generality of pressure registers, with this single difference that here the indications are due to movements of a liquid which are very exact, which cannot be said of all the aneroid or bent tube registers.

I will mention several of the applications possible to registers of (1) pressure of steam in boilers; (2) vacuum in condensers of machines; (3) pressure of compressed or rarefied air; (4) pressure of water in conduits; (5) variation of level of water in reservoirs on the spot or at a distance.

Pressure of Steam in Boilers.—The arrangement will be the same as for the gas pressure, but instead of water we must use mercury.

Thus, for a boiler tested to 12 pounds pressure, we will have sheets graduated up to 13 pounds, so as to have still sufficient if the valves work irregularly.

The pound of pressure corresponding to 13.13 inches of mercury, we will give the tube, *D*, a length of $13.13 \times 13 = 170.69$ inches between the level at *O* and the junction at the tube, *C*, which in this case will not be of lead but of iron of same thickness.

If we use a register of 2.36 inches scale, and a cylinder, *A*, with 2.75 inches diameter, the maximum variations of level will be:

Registers, 2.36 inches; tube, 170.69—2.36 = 168.33.

The sections then will be in the proportion of

2.36 : 138.33, or 1 : 71.327;

and the diameters in this case will be:

As 1 : $\sqrt{71.327}$, or 1 : 8.446.

The tube, *D*, will be, then, .32 inches in diameter, the volume of the mercury necessary being about 20 cubic inches.

With this apparatus, as long as the mercury is above the bottom of the cylinder, for zero and the maximum pressure we will always have a guard in the tube, *D*, and the pressures indicated will be exact—a state of affairs not always found with the aneroid manometers, which are generally either too strong or too weak.

The float may be placed on the mercury or on water, the sole condition necessary, as mentioned above, being that the mercury be some distance above the bottom of the cylinder, *A*, without pressure.

If we feared the steam would condense in sufficiently large quantity in tube *D*, to falsify the indications of the apparatus, it will be easy to remedy it, in order to arrive direct at the steam, by interposing a water holder, *R*, on which the pressure will act and be transmitted to the mercury.

The calculation of the diameters, then would be a little different. We would have:

a. Variation of level in the cylinder of the register.

b. Variation of level in the tube *B*, and the total pressure would be $a + b + \frac{b}{13.6} = P$, in inches of mercury, $\frac{b}{13.6}$ representing the pressure of the water as regards the mercury. The apparatus thus calculated would be strictly accurate.

2. *Vacuum in Condensers of Steam Engines.*—As at the starting of engines, the condensation is not immediate, and as there may be an excess of pressure the manometric tube will have two parts for the vacuum at *D*, and for the pressure at D_2.

The sheet of the register should be divided then in two parts by the

atmospheric, 0; if it is 2.36 inches high, it should have 1.18 inches for vacuum and 1.18 inches for pressure.

In order to give a more rigorous exactness, we will make the transmission of the pressure or suction by means of water.

The manometric tube should be sufficiently long in having 27.9 inches for the vacuum and 27.9 inches for the pressure portion. The section of the tube will be determined by considering the weight of water in the equation:

$$a + b + \frac{b}{13.6} = P.$$

If $a = 1.18$ inches, b will be 25.6 inches, and we have

$$\frac{a}{b} = \frac{1.18}{25.6} = \frac{1}{21.7}$$

If the diameter of A is 2.75 inches,

$$\text{Diameter } D = \frac{\text{Diameter } A,}{\sqrt{21.7}} = \frac{2.75}{\sqrt{21.7}} = .59 \text{ inches.}$$

We see it will be very simple to verify, in an industrial establishment, the work of the boilers as well as that of the engines, and thus obtain the best result.

3. *Pressure of Compressed or Rarefied Air.*—This will need the same arrangement as for steam, but in the calculation of the diameters we will suppress the co-efficient $\frac{b}{13.6}$ If the variations are from 0 to 17.6 pounds, and that it may be more interesting also, from 11 to 17.6 pounds, we may adopt the arrangement of Fig. 4, where on one scale of 2.36 inches height, we may record the variations from

0 to 11 lbs. on a distance of .79 inch.
and 11 to 17.6 lbs. on " 1.57 inches.

Total.....2.36 inches.

	Ratio of Sections.	Ratio of Diameters.
The variations of level will be from 0 to 11 lbs.—register .79 inch tube (27.9 × 11)—.79 = 305.11.....	1 : 386.2	1 : 19.7
From 11 lbs. to 17.6 lbs.—register 1.57 inch tube (27.9 × 6.6)—1.57 = 182.57.....	1 : 116.3	1 : 10.8

If the diameter of the cylinder A is 2.75 inches, it will be sufficient to have a tube, B, with a diameter of .2 inch and a length of 143 inches placed over another of .37 inch diameter and 82.8 inches length.

On the 1.57 inches of scale it will be easy to read $\frac{1}{10}$ of a pound—an approximation more than required in official tests.

4. *Pressure of Water in Pipes.*—By attaching to a system of water works, we can easily have record of the pressure in the pipes. The formula to be employed to calculate D will be

$$a + b + \frac{b}{13.6} = P,$$

pressure in inches of mercury.

5. *Variations of Level in Water of Reservoirs.*—First, on the spot. If the apparatus is placed about 3 feet below the framework of the reservoir, and let the height of this latter be 26 feet, we will mark the sheet of the register as in Fig. 5, because the 0 point is a division above the level of the apparatus at rest.

It will be easy then to ascertain the cost of a water service by keeping record of the filling of the reservoir and its level variations.

Second, variations of level of water in a distant reservoir. Applying the arrangement (Fig. 4), we may trace the register sheet so as to have quite large divisions for the height of the reservoir, and only a few tenths for the difference of level between the bottom of the reservoir and the position of the register.

Suppose this difference to be 100 feet and the height of the reservoir 25 feet. According to the scale (Fig. 6), we have: The .8 inches of the scale represents the 100 feet of height, and the 1.6 inches above represents the 25 feet of the reservoir. The indications will be made then on a scale sufficient to recognize the variations of level of 4 inches, or even 2 inches, in height of the reservoir.

It is very evident that a special pipe must lead from the reservoir to the apparatus, for a connection with a new pipe would only give the difference between the level of the water and the loss due to consumption. The formula to apply will be always

$$a + b + \frac{b}{13.6} = P.$$

It is not necessary to insist on the numerous applications of reduction of scale to manometric registers of gas, water, steam, or other fluid pressure, nor with more reason to dial manometers with float, which might be constructed in the same way.

Incandescent Lamps and Current.

L'Industrie Electrique remarks it was long thought that incandescent lamps taking few watts were economical, but some experiments of MM. Siemens and Halske seem to point to the contrary. This may be economical for the moment, but after, no. The experiments were with lamps to take normally 1.5, 2 and 2.5 watts per normal candle. The actual watts per candle were determined after a given number of hours of burning, with results given in the following table:

Duration of Lighting in Hours.	Lamps Taking Normally 1.5 Watts per Candle.	2 Watts per Candle.	2.5 Watts per Candle.
0	1.52	2.01	2.51
5	1.91	2.03	—
10	2.43	2.21	2.52
15	2.81	2.38	—
20	3.19	2.48	2.52
25	3.40	2.57	—
30	3.77	2.71	2.52
35	4.07	2.91	—
40	4.15	2.98	2.55
45	4.25	3.03	—
50	4.45	3,06	2.69
55	4.46	3.25	—
60	—	3.46	2.71
65	—	3.51	—
70	—	3.63	2.79
75	—	3.67	—
80	—	3.83	2.89
85	—	3.93	—
90	—	3.99	3.01
100	—	—	3.09
110	—	—	3.22
120	—	—	3.26
130	—	—	3.30
140	—	—	3.53
150	—	—	3.58

The result will, perhaps, be better seen from the following:

	1.5 Watts per Candle.	2 Watts per Candle.	2.5 Watts per Candle.
Length of test in hours....	55	90	150
Initial luminosity.....	16	16	16
Final luminosity.....	4. 5	7	10
Initial watts per candle....	1. 5	2	2. 5
Final watts per candle.....	4.46	3.99	3.58

Showing that the lamps initially requiring final watts soon deteriorate and consume more, while those starting with the higher consumption continue to consume more constantly. MM. Siemens and Halske advise the use of lamps requiring from 3 to 3.5 watts per candle, never using those below 3 watts.

Dublin Central Electric Lighting Station.

We are indebted to a correspondent at Cork, Ireland, for the following description of the central electric lighting station at Dublin, Ireland, which description originally appeared in *Engineering:*

Electric lighting is about to be commenced in Dublin in the following streets: Grafton street, College green, Dame street, Capel street, Mary street, Henry street, Sackville street, D'Olier street, College street and Westmoreland street. The current is being supplied by a central station situated in Fleet street, equipped by Messrs. Hammond & Co., of London and Middlesbrough, for the Dublin Corporation, who are undertaking both public and private lighting. For the former, for which 78 posts, of 23 feet height, have been erected, there are provided three Brush dynamos, each giving an output of 10 amperes and 3,000 volts. These are driven by three compound engines of 60-horse power each, running at 220 revolutions, and driving by eight cotton ropes from grooved flywheels of 8 feet diameter. The speed of the dynamos is 800 revolutions; they are fitted with sliding bases in order that the ropes may be readily kept taut. The arc lamps are of 2,000 nominal candle power capacity, and are of the Brockie-Pell type.

For the private lighting there are three sets of alternate current plant, each comprising a Lowrie Parker high tension alternator, a pair of compound horizontal non-condensing engines of 280-horse power, and an exciter. The output of each set is 75 amperes at 2,000 volts, equal to 5,600 lamps of 8 candle power. The engines have Corliss valves, and run at 85 revolutions with 140 pounds of pressure of steam. They were

constructed by Messrs. Coates & Co., of Belfast. Each dynamo is driven by 12 cotton ropes, of 1¼ inch in diameter, from a flywheel 14 feet in diameter, weighing 10 tons. It runs at 350 revolutions per minute, which gives a peripheral speed of 6,000 feet and 83.3 complete alternations per second. The armature is stationary, the field magnet revolving. The former has a laminated iron core, on which are coils of narrow copper tape, wound each on an insulating block, and rounded at the ends. These coils are placed close together on the cylindrical inner surface of the armature ring, so that the axis of each coil is radial to the ring; the coils are secured to the ring by strips of wood screwed to the checks and extending over the ends of the coils, outside the line of travel of the magnets. The field magnet consists of a solid soft wrought iron ring with pole pieces attached; its shaft runs in two bearings, 20 inches long, so arranged that the bottom brass can be removed without lifting the shaft, which is 6 inches in diameter, with solid forged thrust collars. Upon this shaft is a pulley for driving the exciter through four ¾-inch ropes; the size of the pulley is such that the drum armature of the exciter runs at 800 revolutions per minute. The approximate weight of the dynamo, rails and exciter is 12 tons. The foundations of the dynamos are all built of concrete from a depth of 15 feet 6 inches.

Steam is generated in four Babcock & Wilcox water-tube boilers, each capable of evaporating 8,500 pounds of water per hour at a pressure of 150 pounds per square inch. The total grate surface in each boiler is 51 square feet. The four boilers are arranged in two batteries of two each, each battery being provided with a steam receiver. Each boiler is composed of fourteen sections, each comprising eight tubes 4 inches in diameter and 18 feet long. The steam and water drums are 36 inches in diameter and 32 feet 7 inches long, made of steel ½ inch thick, and are provided with the necessary fittings. The boilers are fed by three Worthington steam pumps, the water being heated by three feed heaters supplied with exhaust steam.

The station is provided with switch and test rooms. In the former are connections from the three Lowrie-Parker dynamos, which can either be run on separate mains or in parallel. The mains for the alternators are first brought to safety fuses in the switchboard, and by a system of 4-break switches any dynamo can be put in communication with any circuit or circuits, or the whole be put in parallel circuit. Besides these mains conveying the entire electromotive force of the dynamo, a small wire placed across one coil of the armature is also brought to the switch room; this is for measuring the voltage, synchronizing, and for regulating the pressure.

A simple current meter is also included on the switchboard to indicate to the attendant approximately the current given out by each dynamo. When the maximum safe load of any dynamo is reached, the attendant can either put in another machine parallel, or put one of the circuits on some lighter loaded dynamo, if working independently. The synchronizing is effected through the one-coil circuit; for instance, if one machine shows by the indicator that the load is approaching the normal, and another plant is started, a small switch places the second machine parallel with the first machine, though one lamp only is placed on the sychronizing board. When the phases of the two dynamos correspond, the lamp is steady and bright, but not until then. The second machine is then instantly put in parallel with the first by the insertion of one main switch, and at once takes half the load. A hand regulated resistance is placed in each exciter circuit for varying the voltage, and in addition there are three Lowrie-Hall automatic regulators. These act as shunts of variable resistance on the magnets of the exciters.

The mains are laid in cast iron culverts, varying from 3 inch to 6 inch in diameter, with interchangeable surface boxes every 70 yards. The difference of potential is 3,000 volts for the street lamps, and 2,000 volts for the private lighting. Lowrie-Hall transformers are used to reduce the potential to 100 volts in the houses. Meters of the Schallenbergen type are used to measure the current. For testing the insulation of the mains an instrument is used consisting of a small box containing a vacuum discharge tube provided with sight holes. One terminal of the tube is connected to earth, while the other is put to the cable which it is desired to test. If the insulation is good there is a glow in the tube due to the static charges in the conductor, but if there is any defect in the insulation this glow is diminished according to any earth connection which exists. Should any circuit get dangerously low in resistance to earth it is stopped at a convenient time, either night or day, and the fault localized and removed.

ONE of the small holders on the plant of the Saratoga (N. Y.) Gas Company partially collapsed about a fortnight ago. The damage, however, will not exceed $1,000.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. FREDERIC A. SABBATON, JR., of Troy, N. Y., has been appointed Assistant Professor in Civil Engineering and Mechanical Drawing, at Swarthmore College, Springfield township, Delaware county, Pa. He is an accomplished civil engineer, and is a graduate of the Rensselaer Polytechnic Institute, Troy, N. Y.

WE are indebted to "Observer" for a clipping, from the Worcester (Mass.) *Gazette*, which gives the following particulars respecting the 44th annual meeting of the Worcester (Mass.) Gas Light Company: "At the annual meeting of the Worcester Gas Light Company, Jas. P. Hamilton was chosen Clerk and Treasurer, and the following Directors were re-elected: Messrs. Charles D. Lamson, A. George Bullock, Joseph E. Davis, Waldo Lincoln, Josiah H. Clarke, Francis H. Dewey and Joseph Sargent. The annual report for the year ending June 30th, 1892, by President Charles D. Lamson, was read. The following are some of its salient features: Coal gas made, 87,492,000 cubic feet; water gas made, 60,195,000 cubic feet, or a total of 147,687,000 cubic feet. Gas sold, year ending June 30th, 1892, 139,964,400 feet; gas sold year ending June 30th, 1891, 125,612,000—a gain of 14,352,400 cubic feet, or 11.40 per cent. The loss by leakage and condensation was 8,585,800 cubic feet, or 5.8 per cent. The largest consumption in any 24 hours was on December 24th, 1891, when 803,000 cubic feet were sent out; the smallest consumption in any one day was on July 19th, 1891, when 138,000 cubic feet were used. There were used in the manufacture of gas, 7,877¼ tons of Westmoreland coal, 306,708 gallons of crude oil, 57,379 gallons of naphtha and 69,275 bushels of coke—the latter quantity of material was used in the making of water gas. There were sold 143,872 bushels of coke and 133,528 gallons of tar. The candle power averaged, according to the State Inspector's tests, 19.30. There were in use on June 30th, 1891, 4,835 meters; meters removed during the year, 1,202; meters set during the year, 1,516—or, in use on June 30th, 1892, a net total of 5,149. During the year, 1,307 consumers' meters were tested. The largest number of street lights in use on any one night in the year was 408; smallest number, 295; number now in use, 297. The extensions of street mains during the year have been as follows: 1-inch, 463 feet; 1¼-inch, 86 feet; 1½-inch, 1,439 feet; 2-inch, 4,031 feet; 3-inch, 5,698 feet; 4-inch, 2,489 feet; 6-inch, 1,534 feet; 8-inch, 1,688 feet; 10-inch, 1,381 feet; 20-inch, 1,090 feet—total, gross, 19,899 feet; 4-inch pipe removed from Exchange street, 1,688 feet—or a net extension of 18,211 feet. Number of gas stoves sold, 269; number rented, 36; number in use in the city, on the Company's records, 1,465. It is certain, however, that a much larger number are in use, of which the Company has no authentic record. The additions to and improvements on the plant in the year include a new water gas plant, two horizontal tubular boilers, of 100-horse power each, a new stack of retorts, a large brick tank for tar storage, new exhauster and condensing rooms, located in a reconstructed portion of the old retort house, and a large Walker tar extractor. A new holder was also completed. In speaking of the 10-inch mains the Company is now laying, the report says they are made imperative by the increase in the Company's business. The output of gas for each year since 1888 is as follows:

Year.	Output.
1888	91,725,000 cubic feet.
1889	104,790,000 "
1890	119,019,200 "
1891	125,612,000 "
1892	139,964,000 "

This shows a gain of 48,288,800 cubic feet, or 52.6 per cent. in four years. Authority was asked for the issuing of $150,000 bonds, to be secured by a mortgage on the franchise and all other property of the Company; the bonds to be issued from time to time, as the needs of the Company became apparent. The authority was granted."

THE hearing that was to be had in Boston on September 14th, before the State Board of Gas and Electric Light Commissioners, in the matter of the petition of certain residents of that city for a reduction in gas rates, was postponed to October 5th.

SOME time ago we reported that the proprietors of the Visalia (Cal.) Gas Light and Heat Company had determined to engage in the supply of electric currents, and also to improve the gas plant. Since that mention we are in receipt of the following: "Mr. B. M. Smith, Superintendent of the Visalia Gas Light and Heat Company, says that work on increasing the capacity of the plant will be commenced at once. Two tubular boilers of 50-horse power each have been purchased, and with

those now in use the Company will have a battery of four boilers with a combined power of 200-horse. The engine will be of the best improved modern pattern, and will be of a power well in excess of the present demands on the plant. The driving wheel will be 15 feet in diameter, and the cylinder will be 18 inches by 42 inches. A Thomson-Houston dynamo, equal to the maintenance of 350 incandescent lamps, and an arc dynamo (30-light capacity) of the same type, have been ordered. These, with the dynamo now in use, will place the Company in a position to supply 1,100 electric lights. Some of the poles have already arrived, and will be erected as soon as the City Council designates the places at which the 20 arc lights bargained for by the city for the streets are to be located. It is believed that the city will have five arcs placed on the dome of the court house. The old gas and electric light station buildings are to be remodelled and enlarged to accommodate the new plant. Superintendent Smith expects to have everything in working order by November 15th."

Messrs. H. S. Gillette, J. D. Cameron and William H. Taylor are named as the incorporators of the Joliet Vulcan Gas Company, which it is presumed is to be operated as a fuel gas concern in opposition to the Joliet Gas Company. It is capitalized in $100,000. In the meantime, we do not believe that Messrs. Strong and Elwood, of the old Joliet Company, are very much concerned over this move of the Vulcan speculators; nor do we think they have any reason to be "moved."

The United States Projectile Company, of Brooklyn, N. Y., finding that its present buildings were inadequate to the speedy completion of the orders that are crowding its books, has placed an order with the Berlin Iron Bridge Company, of East Berlin, Conn., for an addition 240 feet long to its shops. The addition will be entirely of iron, from the designs of the Berlin Company.

According to a correspondent, the authorities of Cleveland, O., are again in the throes of an attempt to frame a suitable ordinance for the regulation of the duties of an "official" gas inspector—we say, "again," presuming that our readers remember the odd jumble that was proposed on this same line earlier in the year in Cleveland. Our correspondent reports the present "attempt" in the following summary: "The ordinance, which was introduced by Mr. Caswell, provides that it shall be the duty of the gas inspector to make semi-weekly photometric and 'other tests' of the gas; to keep a record of the pressure, quality and candle power of the gas, and upon a written application, accompanied by an inspection fee of $1, to inspect and determine the correctness of the gas meter designated in the application—the Gas Company must furnish another gas meter during the time of the inspection. If the gas meter is found correct, the fee of $1 is to be turned into the city treasury; but if it is found to be fast the Gas Company must pay a fine of 50 cents to the city." If our correspondent has summarized this ordinance according to the pith of its provisions, the new scheme bids fair to be as odd as its forerunner was.

Early this month a mortgage deed, signed by Messrs. Jones and Jett, on behalf of the Memphis (Tenn.) Gas Light Company, acknowledging the Company's indebtedness to the Manhattan Savings Bank and Trust Company, was filed with the Register. The primary object of the mortgage is to secure the payment of 400 bonds of the value of $1,000 each, payable in 30 years, and bearing interest at the rate of 6 per cent. per annum. The issue was agreed to by shareholders, at a meeting held last June. The mortgage covers the entire plant, franchise, real and personal property. The bonds, from 1 to 60, are to be issued immediately, but those numbered 240 to 400 are to be held to retire the existing 20 year bonds, issued by the Company in April, 1873. The real increase, therefore, in the Company's liabilities is $160,000.

Mr. George A. Martin, who has been in the service of the Laconia (N. H.) Gas Light Company for a quarter of a century, resigned his post about a fortnight ago.

The old station on Eighth avenue of the Duluth (Minn.) Gas and Water Company has been dismantled.

The spacious buildings of St. Elizabeth's Convent, at Madison, N. J., are now supplied with gas from the mains of the Morristown (N. J.) Gas Company.

The capital stock of the Stockton (Cal.) Gas Light and Heat Company has been increased to $1,000,000.

We are indebted to a Chicago correspondent for the following particulars respecting the career of Mr. Cheney Ames, who died in Chicago about a fortnight ago, at the age of 85: "He came to Chicago in 1886, and up to about 18 months ago was prominently identified with the Consumers Gas Company, but failing health induced him to cease active work. Last May, however, he again resumed his connection with the Company, and up to within a few weeks of his death he was in charge of its business connected with the World's Fair. Early in September he was seized with inflammation of the bowels, which terminated fatally on the 14th inst. The remains were removed to Oswego, N. Y., for interment. Deceased was born in Mexico, Oswego County, N. Y., and in his youth identified himself closely with commercial interests, mainly in the hatting trade, in and about Oswego, to which city he removed in 1837. He served several terms in the New York Assembly, and in 1857 was elected to the State Senate, serving for the term as Chairman of the Committee on Commerce and Navigation. On the breaking out of the Rebellion he was made a member of the War Committee of New York State by Governor Morgan, and from that time until peace was declared he gave entire attention to his duties in that capacity. His eldest son was killed in the war. He leaves a widow and six children. Two sons, C. C. and C. F. Ames, and two daughters, live in Chicago."

Mr. John P. Thomas has been appointed to the vacancy that has existed for some time in the Michigan Board of Water and Electric Light Commissioners.

The Vulcan gas process manipulators have also made their appearance at Moline, Ills., where one John D. Cameron has applied to the City Council for a franchise permitting or authorizing himself and associates to build, equip and operate a gas works at Moline, they agreeing to supply illuminating gas at a rate not to exceed $1.25 per 1,000 cubic feet, and fuel gas at 75 cents per 1,000 cubic feet, payment of bills within 10 days to secure a rebate of 10 cents per 1,000. They agree to forfeit the sum of $2,000, on the issuance of the franchise, if work on the plant is not begun 30 days after the signing of the ordinance; or if they have not expended $5,000 on the plant within six months; or if five miles of mains are not put down in the twelvemonth. This Vulcan business does not appear to be trustworthy, in that the exploiters are too greatly in evidence before too many Boards of Council as applicants for gas charters. As at Joliet, however, we incline to the belief that Mr. Davis, of the Peoples Light and Fuel Mfg. Company, of Moline, will be able to take care of the Vulcanites.

Gas men as candidates for important State positions seem to be in high favor just now with the men who dictate the nominations. For instance, the Hon. William H. Haile, President of the Springfield (Mass.) Gas Light Company, is the candidate of the republican party for Governor, and the Hon. John J. Kean, Jr., President of the Elizabeth (N. J.) Gas Light Company, appears before the republicans of New Jersey as the candidate for Governor.

That gas as a fuel for domestic purposes is making great headway in New York city may be taken for granted; nor is this growth or extension a spasmodic one—it is steady, and is in an expanding ratio. As an instance of this we report the following contracts recently completed by the American Meter Company, in fitting up new apartment houses with the Company's well-known type of Economy gas cooking apparatus: 1st order, 28 "Eight-a" cast iron stoves; 2nd order, 30 "Seven-a" cast stoves; 3d order, 11 "Eight-a" stoves; 4th order, 32 "Eight-a" stoves. These were all put in place, with hoods, pipes and everything complete, after the manner of restaurant ranges.

Speaking of restaurant ranges recalls the fact that the proprietors of the Clarendon Hotel, the "swell" house of Brooklyn, have added to their kitchens a complete set of broilers, of the Gibbons type, and the Gages, father and son, who manage an excellent restaurant on Montague street, close to the Academy of Music, have also installed a set of Gibbons' gas broilers. If we mistake not, the Gibbons apparatus is now exclusively handled by Messrs. Crane & Co., the agents in this city for the goods of the Maryland Meter and Manufacturing Company.

Attention is called to the fact that the offices of the American Meter Company, in Cincinnati, Ohio, have been removed from 177 Elm street, to No. 380 Main street.

An unusual cause for an action at law recently came to light in a suit for damages instituted in the Court of Common Pleas, No. IV., Philadelphia. The plaintiffs—Messrs. James C. Drayon and Francis C. Richter—sue the Northern Electric Light and Power Company for $1,000 damages, caused by the failure of the Company to maintain the arc lights bargained for by the plaintiffs on the night of July 4th, dur-

ing the performance of the "Pawnee Bill" and "Wild West" open air entertainments at Forepaugh Park. The plaintiffs assert that the extinction of the lamps obliged them to return the entrance moneys paid by 2,000 visitors.

A HITCH is reported in the final proceedings respecting the amalgamation of the Municipal Gas and the Electrical Illuminating Companies, of Albany, N. Y. The Directors and the shareholders in the respective corporations had agreed upon the details of the consolidation, and it was presumed that the matter was at end, but when the Gas Company attempted to have its certificate of incorporation amended so as to permit it to take up the business of electric lighting, the Secretary of State refused to file the certificate. He based his refusal on the ground that under Section 60 of the Transportation Corporation law, the certificate could only name one kind of business. Mr. Marcus T. Hun, as attorney for the Gas Company, has served the Secretary of State with an order to show cause before the Supreme Court why he should not be compelled to file the certificate as presented. To an outsider, the objection lodged by the Secretary of State (Mr. Frank Rice) looks to be decidedly of the finical order.

THE New York *Advertiser*, of the 18th inst., reports that Mr. Samuel H. Hoey, who was appointed Receiver, in April last, of the Welsbach Incandescent Gas Light Company, of this city, in proceedings for voluntary dissolution, has been authorized by Judge Beach, of the Supreme Court, to pay out of the moneys in his hands a dividend of $1.14 for each partly paid share in the capital stock of the Company. We are informed that each shareholder loses about 86 cents on each $2 (cash) paid in. About this last, however, we are not certain.

LAST year the Aldermen and Council of Haverhill, Mass., passed the preliminary order, under the State laws, authorizing the establishment by the city of a municipal gas and electric lighting plant. As under the laws it is necessary that the order be passed for two consecutive years, the Council and Aldermen, something over a week ago, readopted the order of 1891. The next step is to submit the measure to the citizens for a ballot, and the election therefor will be called soon—likely in November.

A SLIGHT fire is reported to have occurred in the meter room of the Dorchester (Mass.) Gas Light Company. The employees quelled it speedily, and the damage was less than $100.

SUPT. DYE, of the Rutland (Vt.) works, is hard at work making changes in the main system.

SUPT. HAYDEN, of the Bath (Me.) Gas and Electric Company, is at his ease just now, having about completed the plant improvements that have been engaging his attention since the last meeting of the New England Association. He gives great credit—and justly so—to the contractors, the Messrs. Waldo Bros., the Davis & Farnum Manufacturing Company, the Wilbraham Bros., and Nathaniel Tufts. Each of these firms came to time in their usual clocklike fashion. The Bath folks now have a model gas works.

"OBSERVER" forwards the following from New Bedford, Mass., which goes to show how small sticks may be responsible for big gaps: "The brick building housing the gasometer at the New Bedford gas works had just received a coating of paint, and while the workmen were engaged lowering the staging from the dome tower, on the inside, one of the men who sat astride of the window sill, discovering that he was losing his balance, to save himself, leaned outward and let go of a 3 inch by 4 inch joist. At the same time, another workman on the inside, who had hold of the same stick, noticing his partner's plight, also let go in order to save himself from falling nearly 75 feet. The men saved themselves, but the stick—the holder was inflated at the time—fell, end on, on the holder crown, breaking a hole in the same. Before the gash was closed about 25,000 cubic feet of gas had escaped."

AT the annual meeting of the shareholders of the Woonsocket (R. I.) Gas Company the following officers were chosen: Directors, Henry C. Kimball, Joseph B. Aldrich, John W. Ellis, H. F. Lippitt, George M. Weller, Joseph E. Cole, James P. Ray, Frank Harris, and Gilbert Darling; President, Henry C. Kimball; Secretary and Treasurer, Reuben G. Randall.

THE new machinery for the Wallingford (Conn.) Gas Light Company will be in position by November 1st.

THE Cooperstown N.Y.) Gas Company and the Cooperstown Electric Company have been consolidated. Each division is capitalized in $12,500. The Directors chosen as the result of the consolidation are Messrs. Oliver R. Butler, of Cooperstown, Robert E. Drake and Paul T. Brady, of Syracuse, and Charles B. Staats and Fred. E. Wadhams, of Albany. This is the Company which was in financial difficulties some months ago through the transactions of Dudley Farlin, of Albany, N. Y.

LESSEE MEYER, of the Livermore (Cal.) gas works is greatly encouraged at the prospect of increasing the output in this lively California town.

MR. WILLIAM TRACY, of the Alton (Ills.) works, paid us a visit last week. He says that the sendout increases every day, and believes that gas more than ever is the light of the present—notwithstanding that electric annex of his.

THE following is a synopsis of the annual meeting of the Jamaica Plain (Mass.) Gas Light Company: "At the annual meeting of the Jamaica Plain Gas Light Company some interesting facts regarding the growth and business of the Company were presented, in which the public will be interested. It is not generally known that the Company has about 40 miles of mains extending from Hogg's Bridge, Roxbury, to the Dedham line; that during the past year the demand on the Company has been so great that over eight miles of new mains have been laid in Roslindale and West Roxbury; also, that the number of gas retorts has been doubled at the works. These improvements have caused an outlay of nearly $50,000, and a like amount of additional stock was voted at this meeting, increasing the capital to $300,000, which money will be expended in the erection of a new gas holder and in other ways increase the capacity of the plant. The public who have not visited West Roxbury the past year, do not fully appreciate the great growth of this section and consequently the unprecedented demand which has been made of the Company for gas. If at times this summer there has been some little cause for complaint from consumers, it has come, not from a desire on the part of the management to serve the public in any but the best manner, but from lack of capacity at the works, due to the increased output at a time when the works had been all torn up in making needed improvements. But now, the Company is happy to state, that it is in condition to meet the demand of the coming winter and expect no trouble. As to the price of gas, a committee was appointed to look into the matter of a reduction and report at an early meeting of the Board of Directors. It will be the policy of the management to reduce the price of gas as fast as the business will warrant. It should be borne in mind that the new extensions do not usually return a dividend until from 3 to 5 years after they are made, and also the further fact that the Company has only about 40 consumers to the mile of pipe, which is less than most of the other Companies in and about Boston. The Boston Gas Light Company has 223 consumers to the mile of pipe, Roxbury 104 and Dorchester 51, and Brookline claims 30. The Brookline Company charges $1.90 per 1,000 feet, but the Jamaica Plain Company charges $2, which is cheaper proportionately to the number of consumers per mile of mains than any other Company hereabout, excepting, possibly, the Brookline Company. The Company hopes to meet the demand of the community as to extension, quality and price. The following named gentlemen declined re-election: F. A. Peters, President; Geo. W. Kenyon, Treasurer and Secretary; and Andrew J. Peters, F. A. Peters and Prof. Chas. H. Wing, Directors. A vote of thanks was passed to the former President, Mr. F. A. Peters, for his able and efficient management the past four years, and to Mr. Geo. W. Kenyon, who retires from the Treasurership to devote himself to the demands of his increasing insurance business. The following Board of Management was then elected: E. N. Foss, President; Robt. W. Pratt, Treasurer and Secretary; E. N. Foss, Edwin A. Hildreth, Chas. F. Curtis, Mark R. Wendell, Fred. Seaver, Frank S. Pratt, F. P. Robinson, Directors. Mr. F. A. Peters retires from the Presidency of the Company, having served in that capacity for the past four years; his executive ability and excellent management of its affairs have been appreciated by the Board of Directors, who have entertained the highest regard for him, and among whom perfect harmony has always prevailed. Mr. G. W. Kenyon has been Treasurer for four years, succeeding the late J. Philips George, under whom he served as clerk for eight years. The newly elected President, Mr. E. N. Foss, Manager of the Sturtevant Blower Works, is well known in Jamaica Plain, and his long connection with this firm fully qualifies him for the duties of the new position. Mr. Robert W. Pratt, the new Treasurer, is a son of the late John C. Pratt, formerly President of this Company, and has been for 11 years in the U. S. Sub-Treasury, a position which he resigned a month ago. The Company thus enters upon a new year of business, and, as intimated above, with a desire to cater to the wants of this community in the best possible

manner. Of the new Directors, Mr. M. R. Wendell is a well known resident and formerly held a similar position on the Board, Mr. F. S. Pratt is a brother of the new Treasurer, and Mr. F. P. Robinson is a resident of West Roxbury, a son of Mr. A. J. Robinson."

THE proposition to install an auxiliary water gas plant on the works of the Richmond (Va.) municipality is to be again presented to the attention of the City Council. This time it looks as though the measure would be passed.

THE authorities at Wilmington, Del., have accepted the proposition of the Wilmington Coal Gas Company, under which the latter agreed to contribute $1,000 towards the construction of what is known as the Washington street bridge, if the city would permit the Company to lay a gas main along the structure.

THE plant of the Montgomery (Ala.) Light Company has been practically rebuilt.

THE Chicago Fuel Gas Appliance Company has been incorporated by Messrs. J. H. Wyman, F. A. Schlieper and C. A. Jay. It is capitalized in $50,000.

Inferiority of Australian Coke.

The Hon. John See, Colonial Treasurer of Australia, makes public the following letter received by him some time ago from the Secretary of the Broken-Hill Proprietary Smelting Company, of Australia, respecting Australian cokes and their relative values with English and German cokes :

We have from time to time given the colonial coke of different brands fair and impartial trials, and have, on every occasion, noted with the greatest care and attention, and recorded the value of the same when compared with the English and German makes. We find that the colonial coke carries, on an average, fully 6 per cent. more of ash than the English brands which we have been using during the last one and a half years, but it is not in this respect that the greatest element of inferiority comes in. One of the worst points in the colonial coke is that it is of a very friable nature, and generally arrives at the mine in very small pieces, rendering it almost entirely unfit for smelting purposes when fine lead ores have to be treated as in our case here, and only the strongest, coarsest coke that can be turned out will answer for our use. Coke which is friable and easily broken either in transit or in putting into the furnaces is not only the cause of much loss so far as the value is concerned, but it interferes very seriously with the smelting, for it becomes embedded in the slags and absorbs the lead, and is not at all fusible, a very large proportion of it passing out of the furnace in the slags unburnt. In addition to this, a large percentage of the coke is actually lost by abrasion in transport from Newcastle or the other coke-producing ports to Broken-Hill, and frequently this loss is as high as 9 per cent.; this quantity has to be screened out, and is simply a loss to us. Also, there is in the colonial coke more or less of a slaty material, a component part which is a great detriment to our smelting work, as it takes more fuel to burn and melt the slaty contents of the coke than it does to melt any of the many other materials forming the furnace charge ; and altogether, on account of its high percentage of ash and other deleterious matters, it takes more of the coke to do the work, thus reducing the smelting capacity of the furnaces, besides rendering the running of the smelters very irregular, with loss of time and great losses in fluxes.

The difference in quality between the colonial and foreign cokes has been so great that we have been compelled to get the English and German brands to the almost entire exclusion of the Australian mauufacture ; but if we could get the local stuff fit for use we should do so. I submit that we have certainly given the Australian cokes a fair testing.

If the producers would wash and dress the coal more, as the English and German manufacturers do, and take more care in burning the coke, thereby producing a coarse, dense article, carrying less ash and less of other deleterious compounds, there would not be the slightest objection whatever to its being adopted almost entirely here. As a matter of fact, we should much prefer to be able to get stocks close at hand at such times as we wanted it to bringing it such a long distance, with all the annoyance and disappointment of overdue vessels and losses at sea. But one thing is very certain, until the coke producers out here can give forth a very much better article than we have had up to the present, we have no other course than to go to the continent for our supplies. The loss of coke by abrasion and dust, even of "Hood's furnace" and "Standard," which are hard and substantial makes, has been fully 7 per cent., whilst the soft colonial coke loses fully 4 per cent. more. This, if taken together with the slaty substance before referred to, would make the colonial manufacture an extremely expensive purchase, not taking other points into consideration. We receive like complaints about our Australian brands from our smelting manager at Port Pirie, who has an advantage over Broken-Hill in its use, inasmuch as when he receives it the coke has not been handled so much as is the case at Broken-Hill. The difficulty which is the principal one down there seems to be the fact of the coke crushing after being placed in the furnace, and in its not possessing of itself sufficient strength to bear the weight of the furnace charge in transit through the smelter, frequently causing what is known as the double-banking of the furnace, besides many other inconveniences which are invariably incidental to smelting with a poor quality of coke.

In our opinion the manufacturers of the colonial article have no one to blame but themselves for the decision which we have been compelled to arrive at. The coal, it would seem, is quite good enough to make excellent coke if the manufacture were carried out properly ; and I do not see how it would be possible for us to use the coke profitably until they resort to the washing and dressing of the coal used for its production, in the same manner as their brethren in England and Europe do.

Colonial coke averages 6 per cent. more ash than English. At the present time we are using about 1,000 tons of coke per week. The extra ash in the colonial coke would call for the use of 80 tons additional coke in the week, and would reduce the capacity of the furnaces by 70 tons of ore per week, and would necessitate 70 tons more flux being used in the same period, or altogether the use of colonial coke instead of English would mulct the company in the sum $3,225 weekly, made up as follows : 80 tons of coke, at $25 per ton, $2,000 ; profit on 70 tons of ore, at (say) $12.50, $875 ; 70 tons of flux (iron and lime), at $5, $350 ; $3,225 per week. This estimate is entirely independent of the inferior physical characteristics of the colonial coke. We estimate our loss in handling English coke at 7 per cent.; with colonial coke it would be from 10 to 12 per cent. Most colonial coke can stand no burden ; it crumbles up quickly in the furnace and fills the space around the tuyeres with fine coke, causing large losses in lead and silver, both chemically and mechanically.

This question has not been lightly dealt with, but careful analyses and examinations and reports have been made on very many occasions, when lots of colonial cokes have been purchased for use at Broken Hill (and this has occurred very frequently), and there is not the slightest prejudice against the coke at all ; but we find from actual experience that the stuff is inferior to such a degree that its use to any great extent is entirely out of the question, and we have no other course open to us but to get the English or Continental make.

A Movable Coke Oven.

The Connellsville *Courier* recently printed a description of a new design of coke oven recently invented by Hugh Kennedy, manager of the blast furnaces of the Isabella Furnace Company, at Sharpsburg, Pa. It is as follows :

An entirely unique and simple design of a rapid self-discharging coke oven has been invented by Hugh Kennedy, of Sharpsburg, Pa. It is in actual operation at the Isabella Coke Works, at Coketon, Pa. The oven proper consists of a cylindrical frame of plate steel 6 feet high by 12 feet 6 inches diameter, strengthened and stiffened by a 6 by 6 inch angle and made sufficiently strong to resist all expansion of the brickwork under the action of the heat of the coking coal.

To the cylindrical shell are securely riveted heavy wrought steel brackets inclosing four steel axles bearing directly on car wheels. These brackets and wheels are braced and stiffened properly so as to avoid any sagging or twisting motion that may be induced by moving the oven. The oven is then placed on rails and lined as a common, ordinary beehive oven ; but it has no contact with the foundation, except through the wheels to the rails, the arch resting in 6 by 6 inch angle.

The coal when coked in an ordinary oven is first watered and the fire extinguished before it can be drawn. This watering must necessarily cool the oven all over to a certain extent, and consequently when recharged it will take the coal longer to ignite. With the Kennedy oven, when the charge is properly coked, the small traveling car is run back of the oven, the hook of the ram is attached, and the engine, which consists of a small, simple, double-acting, reversing engine, is started, and by means of a rack and pinion pushes the oven off its bed and carries the coke with it, which drops, piece by piece, into the pit in front of the foundation, where it can be thoroughly watered and handled. The oven is then drawn back on the main foundation as hot as when started, and recharged with coal, which ignites the moment it touches the bottom.

As a great deal of coke is shipped in covered or box cars, as well as open tops, it is necessary to arrange to load them as well as the others. This is effected by means of four swinging doors in the bottom of a shute. The doors are placed between the supporting rails and made to swing back out of the way, thus allowing the coke to fall to the loading floor below, which is on a level with the floor of the car, and from which coke can be conveniently loaded. The amount of time saved in drawing, charging and igniting is equal to a large increase in capacity. When the work is properly performed the whole operation, from drawing to ignition, need not be 10 minutes, a wonderful saving. The coke produced at Cokeville in the oven is as good as that produced in the ordinary beehive oven.

The Market for Gas Securities.

Strength was the feature of last week's trading in gas shares on the Exchange, although very little was actually done in Consolidated. Yesterday (Thursday) 45 shares Consolidated were sold on the Exchange, and even that small total was cut up in two or more lots, with a difference of almost one point in the sales' rates—from 115½ to 116¾. As before remarked in these columns, there is a feeling that the Legislature this winter will again tackle the matter of gas rates in our two largest cities, but despite that feeling prices are remarkably well maintained. Mutual maintains its recent advance, and the knowledge of the Company's excellent financial position is now common property. Equitable is not only showing remarkable present firmness, but there is every indication that in the near future much higher figures will be made in it. Standard is steady, and shareholders need not give undue thought to the present lapse in dividends, for the lapse under the purposes thereof, ought to be agreed to by those who believe in sound financial management.

Brooklyn shares show no particular change; strength and dullness are the ruling characteristics. We quote a price to-day for the first time on Equity shares, and the quotation is a *bona fide* one. Chicago gas has recovered from its temporary depression, the opening price to day (Friday) being 81¾ to 82. Baltimore Consolidated is back again to 60, at which figure it is a purchase. Laclede common is quoted at 22¼ to 23, and the bonds are in somewhat better demand. It is said that the U. G. I. Company have taken the contract to construct a 6 million per day plant for the East River Company, but we are not informed that the contractors have also agreed to drive the tunnel. This deal is being watched with a vast amount of curiosity.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

September 26.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	115½	116½
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	154	158
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	145	150
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	35	—
Preferred	5,000,000	100	—	85
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	135	140
Citizens	1,200,000	20	113¾	114
" S. F. Bonds	320,000	1000	—	103
Equity Gas Light Co	2,000,000	100	37	—
Bonds	1,000,000	—	—	85
Fulton Municipal	3,000,000	100	138	140
" Bonds	300,000		102	—
Peoples	1,000,000	10	94	95
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	115	118
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	150	—
" Offs	700,000	1000	99	100
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	107	110

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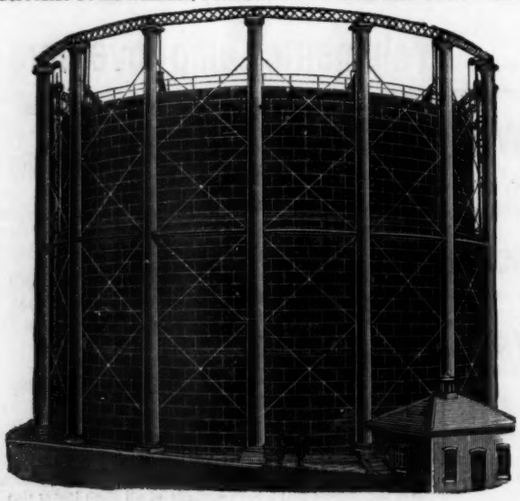

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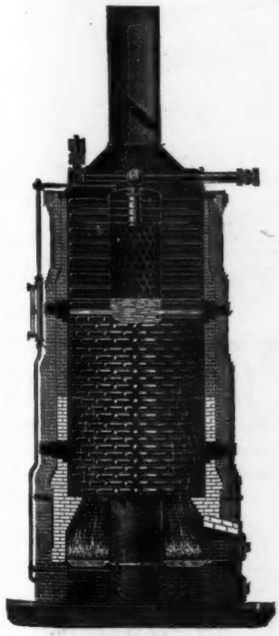

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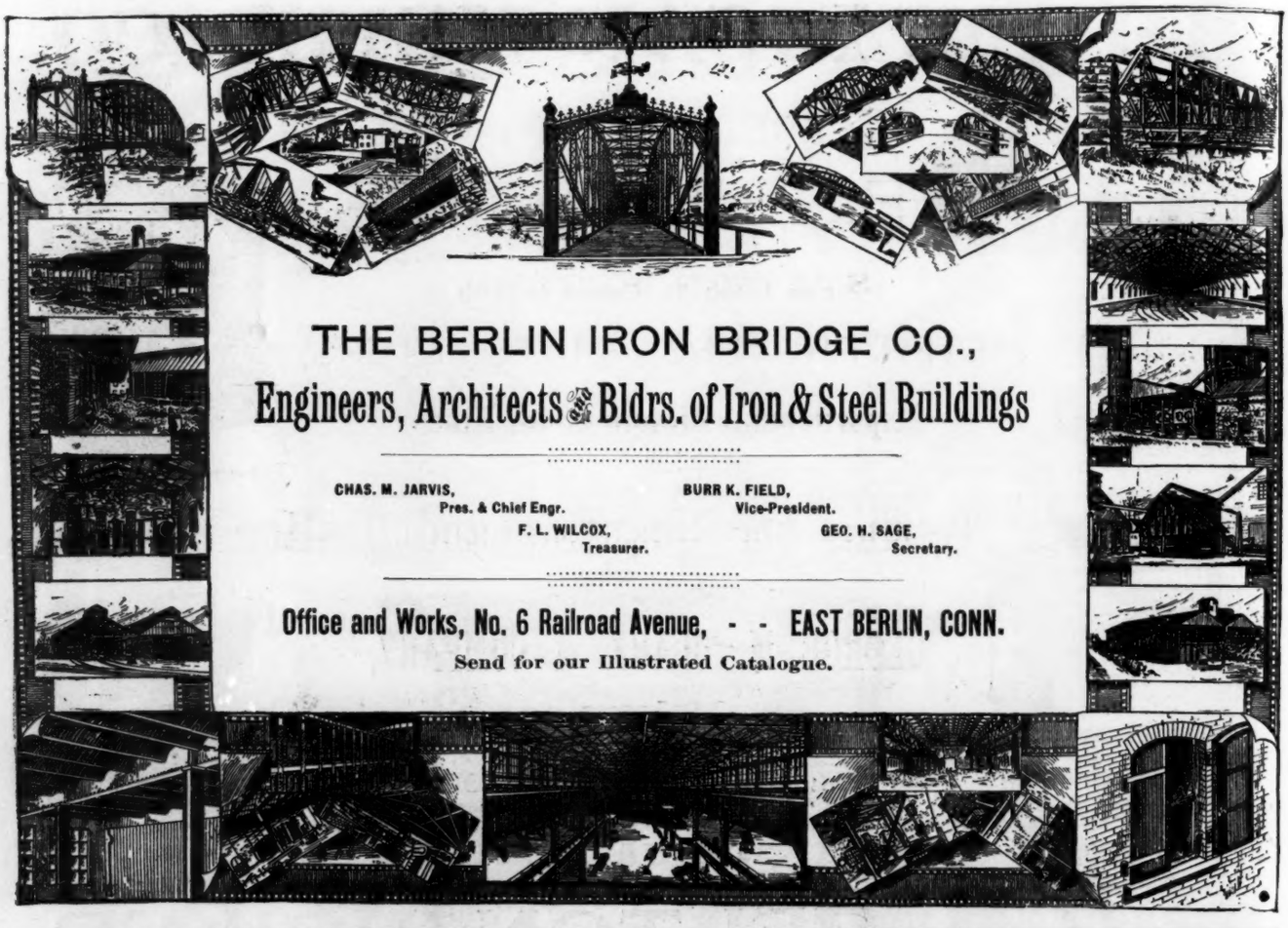

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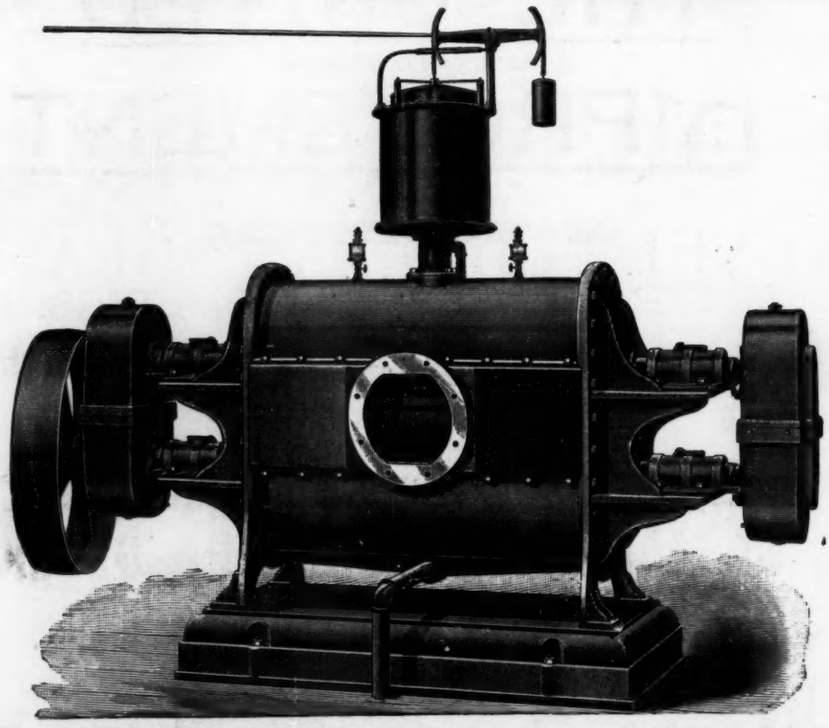

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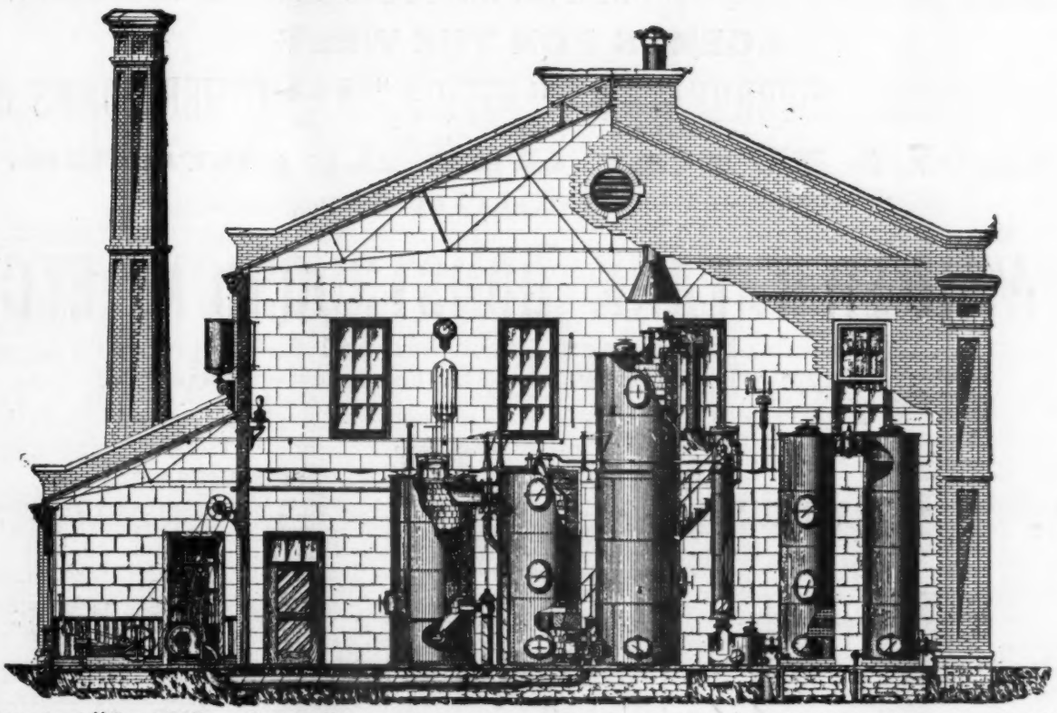

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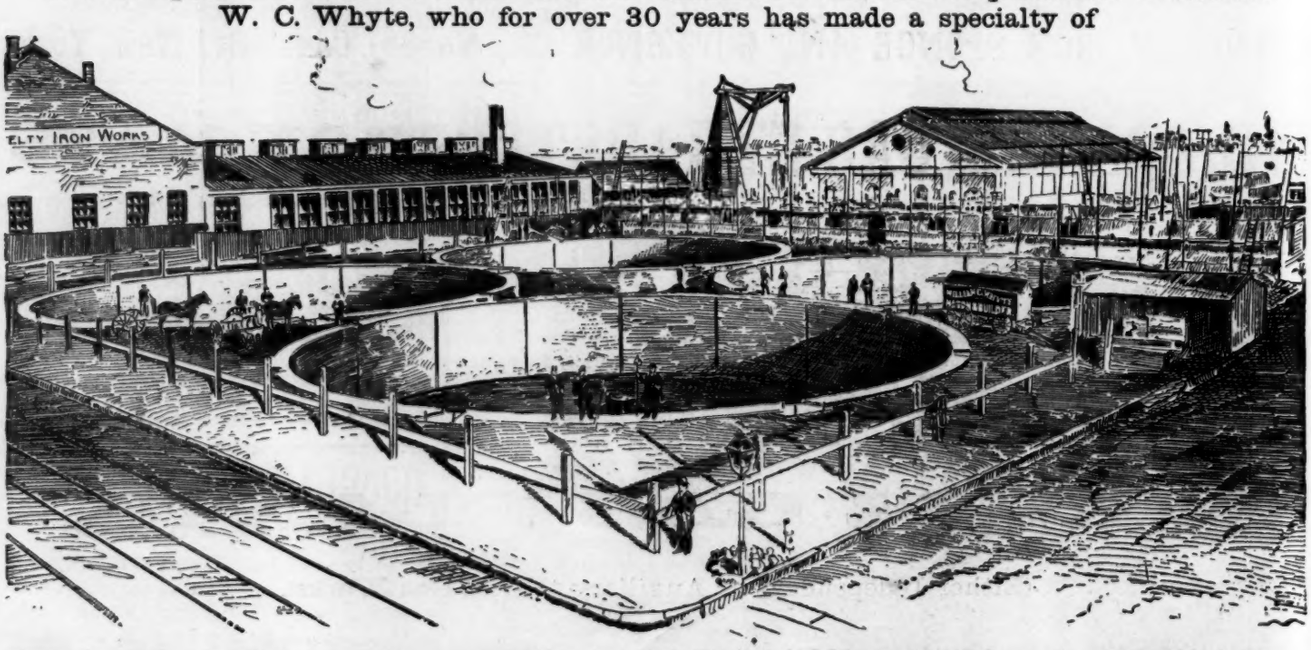

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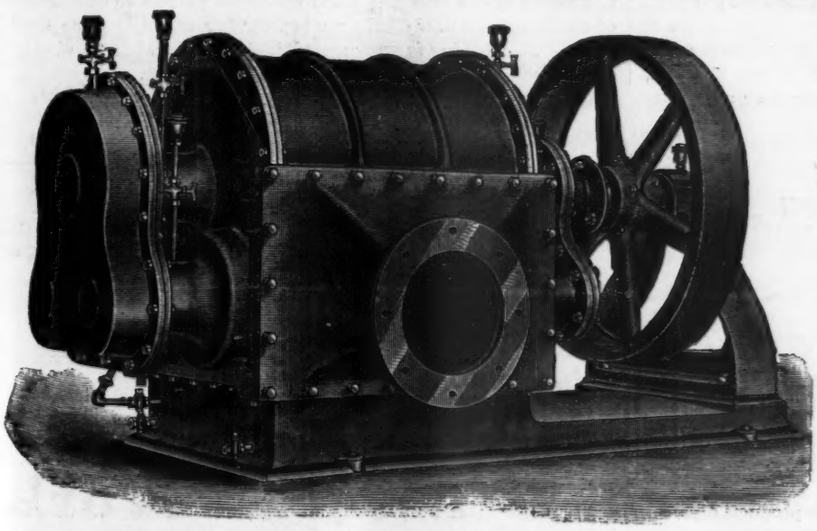

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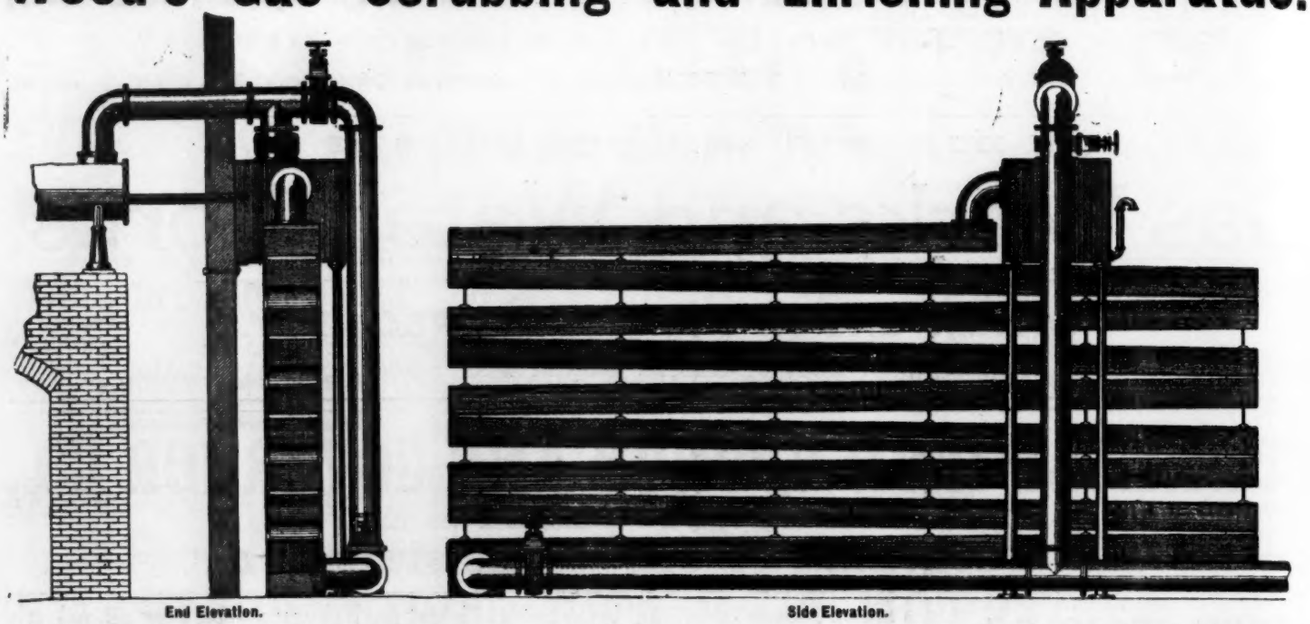

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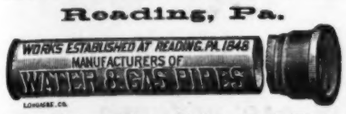

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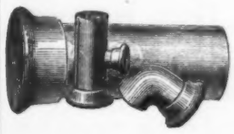

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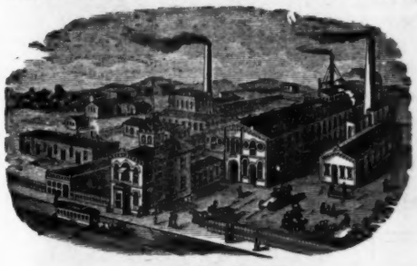

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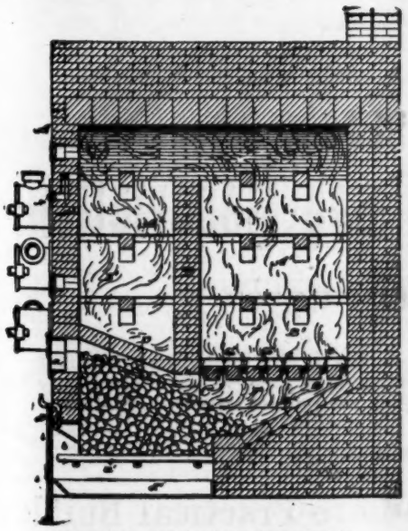

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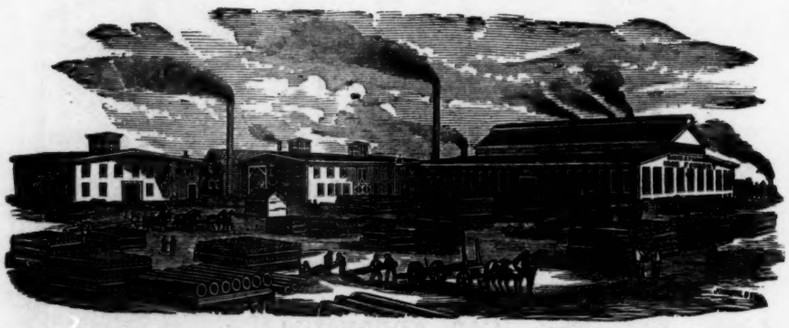

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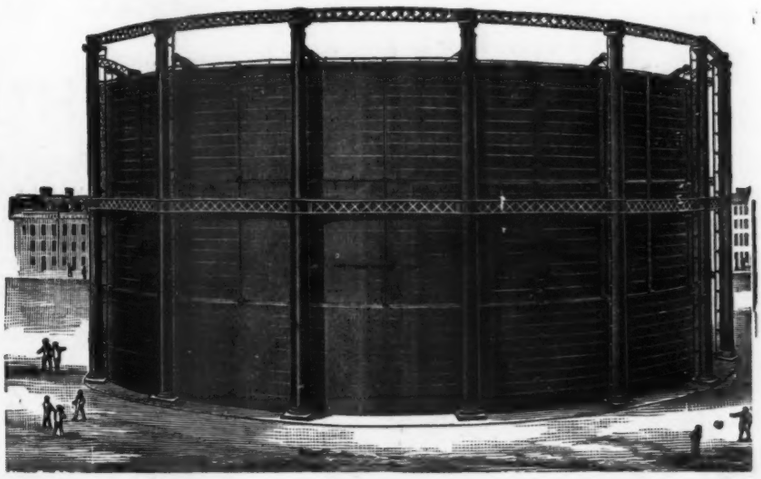

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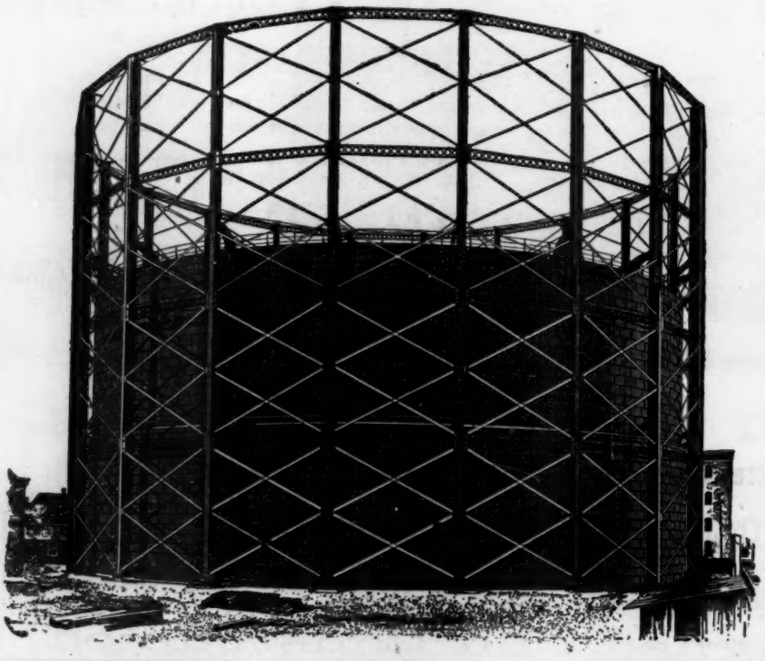

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Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high.	9¼ inches high.	10 inches high.	21 inches high.
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